Local Government Energy Audit:
Energy Audit Report

Water Works

City of Trenton

333 Cortland Street
Trenton, New Jersey 08638

City of Trenton
December 31, 2018

Final Report by:
TRC Energy Services

Disclaimer

The intent of this energy analysis report is to identify energy savings opportunities and recommend upgrades to the facility's energy using equipment and systems. Approximate savings are included in this report to help make decisions about reducing energy use at the facility. This report, however, is not intended to serve as a detailed engineering design document. Further design and analysis may be necessary in order to implement some of the measures recommended in this report.

The energy conservation measures and estimates of energy savings have been reviewed for technical accuracy. However, estimates of final energy savings are not guaranteed, because final savings may depend on behavioral factors and other uncontrollable variables. TRC Energy Services (TRC) and New Jersey Board of Public Utilities (NJBPU) shall in no event be liable should the actual energy savings vary.

Estimated installation costs are based on TRC's experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from *RS Means*. The owner of the facility is encouraged to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Since actual installed costs can vary widely for certain measures and conditions, TRC and NJBPU do not guarantee installed cost estimates and shall in no event be held liable should actual installed costs vary from estimates.

New Jersey's Clean Energy Program (NJCEP) incentive values provided in this report are estimates based on program information available at the time of the report. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. The owner of the facility should review available program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

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1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for the Water Works.

The goal of an LGEA report is to provide public facilities and local governments with valuable information on their facilities' energy usage. Each LGEA report includes specific energy conservation measures (ECMs) and energy management options, which have been determined to be likely to benefit that facility. The LGEA report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) and other sources which may be available to assist with ECM implementation.

This study was conducted by TRC Energy Services (TRC), as part of a comprehensive effort to assist New Jersey local governments with controlling their energy costs and help protect our environment by promoting more efficient use of energy resources statewide.

1.1 Facility Summary

The Water Works is a 35,517 square foot facility comprised of office space, warehouse space and mechanic garages. The building also has several exterior truck garage bays which are unconditioned but illuminated. The water works building is 100% heated and cooled by various HVAC systems and equipment. The facility has two floors and was originally built in 1958. The facility is in operation year-round with operating hours Monday through Friday between 8:00 AM and 4:30 PM with afterhours cleaning. There is a stand by crew that occupies the building on weekends between 4:30 PM and 9:00 PM, with a higher number of staff in the winter in comparison to the summer. On average, the building is occupied by about 250 people.

Lighting, heating and cooling equipment at the Water Works consists of aging and inefficient equipment that was evaluated for replacement. However, some of these measures are cost prohibitive. A thorough description of the facility and our observations are located in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated 15 energy conservation measures. Together these 15 ECMs represent an opportunity for Water Works to reduce annual energy costs by $25,272 and annual greenhouse gas emissions by 211,699 lbs CO_2e (see Figure 2 below). We estimate that if all evaluated measures are implemented, the project would pay for itself in energy savings in 12.2 years while reducing utility costs by 42%. A breakdown of current utility costs is shown in Figure 1.

TRC recommends 12 energy conservation measures. The estimated reduction in utility costs for these high priority measures is in shown in Figure 3. Together these 12 ECMs represent an opportunity to reduce utility costs by 36%. We estimate that if these recommended measures were implemented, the project would pay for itself in energy savings alone in 7.2 years.

Figure 1 – Previous 12 Month Utility Costs

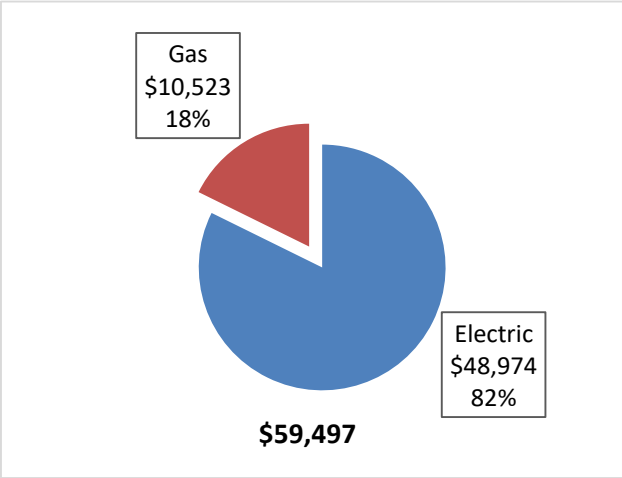


Figure 2 – Potential Post-Implementation Costs (All Evaluated Measures)

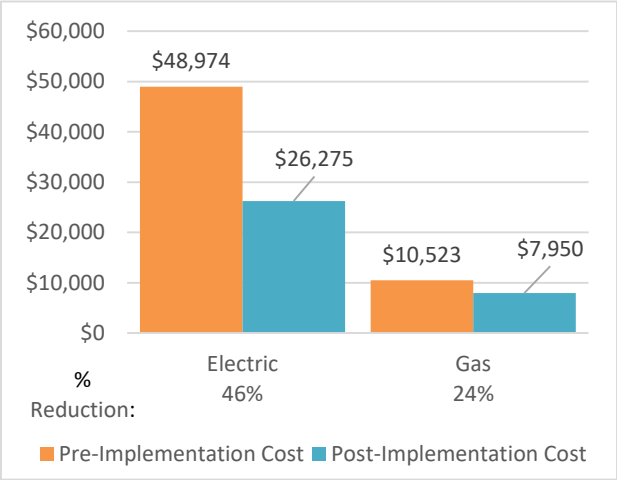
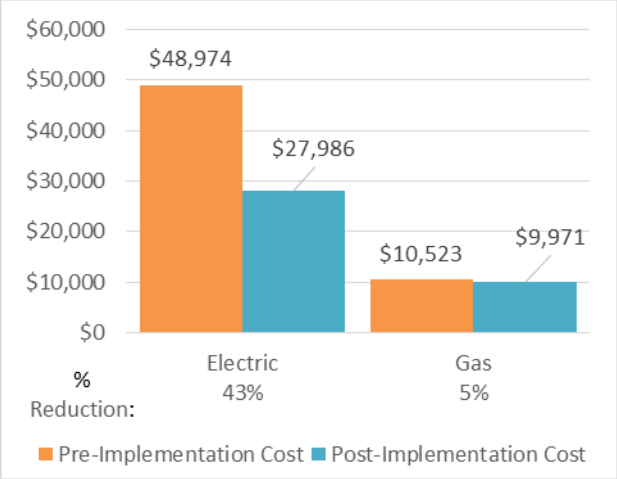


Figure 3 – Potential Post-Implementation Costs (High Priority Measures)



A detailed description of the Water Works existing energy use can be found in Section 3.

Estimates of the total cost, energy savings, and financial incentives for the proposed energy efficient upgrades are summarized below in Figure 4. A brief description of each category can be found below and a description of savings opportunities can be found in Section 4.

Figure 4 – Summary of Energy Reduction Opportunities

	Energy Conservation Measure	Recommend?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**98,493**	**17.8**	**0.0**	**$12,798.73**	**$99,816.01**	**$12,345.00**	**$87,471.01**	**6.8**	**99,181**
ECM 1	Install LED Fixtures	Yes	52,618	5.4	0.0	$6,837.55	$67,826.44	$6,725.00	$61,101.44	8.9	52,986
ECM 2	Retrofit Fixtures with LED Lamps	Yes	43,005	12.1	0.0	$5,588.26	$29,838.47	$5,620.00	$24,218.47	4.3	43,305
ECM 3	Install LED Exit Signs	Yes	2,870	0.2	0.0	$372.92	$2,151.10	$0.00	$2,151.10	5.8	2,890
Lighting Control Measures			**10,359**	**2.9**	**0.0**	**$1,346.05**	**$9,608.00**	**$1,030.00**	**$8,578.00**	**6.4**	**10,431**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	10,359	2.9	0.0	$1,346.05	$9,608.00	$1,030.00	$8,578.00	6.4	10,431
Motor Upgrades			**2,221**	**0.5**	**0.0**	**$288.62**	**$3,201.48**	**$0.00**	**$3,201.48**	**11.1**	**2,237**
ECM 5	Premium Efficiency Motors	Yes	2,221	0.5	0.0	$288.62	$3,201.48	$0.00	$3,201.48	11.1	2,237
Variable Frequency Drive (VFD) Measures			**23,006**	**2.5**	**0.0**	**$2,989.51**	**$13,103.40**	**$0.00**	**$13,103.40**	**4.4**	**23,167**
ECM 6	Install VFDs on Chilled Water Pumps	Yes	10,163	1.3	0.0	$1,320.60	$6,551.70	$0.00	$6,551.70	5.0	10,234
ECM 7	Install VFDs on Hot Water Pumps	Yes	12,843	1.3	0.0	$1,668.90	$6,551.70	$0.00	$6,551.70	3.9	12,933
Electric Unitary HVAC Measures			**15,193**	**5.4**	**0.0**	**$1,974.32**	**$35,987.70**	**$1,380.00**	**$34,607.70**	**17.5**	**15,300**
ECM 8	Install High Efficiency Heat Pumps	Yes	15,193	5.4	0.0	$1,974.32	$35,987.70	$1,380.00	$34,607.70	17.5	15,300
Electric Chiller Replacement			**7,419**	**7.1**	**0.0**	**$964.10**	**$75,628.30**	**$4,950.00**	**$70,678.30**	**73.3**	**7,471**
	Install High Efficiency Chillers	No	7,419	7.1	0.0	$964.10	$75,628.30	$4,950.00	$70,678.30	73.3	7,471
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**119.4**	**$1,004.82**	**$32,596.65**	**$2,987.60**	**$29,609.05**	**29.5**	**13,981**
	Install High Efficiency Hot Water Boilers	No	0	0.0	119.4	$1,004.82	$32,596.65	$2,987.60	$29,609.05	29.5	13,981
Domestic Water Heating Upgrade			**0**	**0.0**	**17.4**	**$146.39**	**$64.53**	**$0.00**	**$64.53**	**0.4**	**2,037**
ECM 9	Install Low-Flow Domestic Hot Water Devices	Yes	0	0.0	17.4	$146.39	$64.53	$0.00	$64.53	0.4	2,037
Plug Load Equipment Control - Vending Machine			**3,224**	**0.0**	**0.0**	**$418.90**	**$460.00**	**$0.00**	**$460.00**	**1.1**	**3,246**
ECM 10	Vending Machine Control	Yes	3,224	0.0	0.0	$418.90	$460.00	$0.00	$460.00	1.1	3,246
Custom Measures			**14,769**	**0.0**	**168.9**	**$3,340.50**	**$61,195.50**	**$0.00**	**$61,195.50**	**18.3**	**34,649**
ECM 11	Computer Power Management Software	Yes	8,873	0.0	0.0	$1,152.99	$3,385.00	$0.00	$3,385.00	2.9	8,935
ECM 12	Building Envelope Weatherization	Yes	145	0.0	48.3	$424.99	$4,535.00	$0.00	$4,535.00	10.7	5,797
	Installation of an Energy Management System	No	5,751	0.0	120.6	$1,762.52	$53,275.50	$0.00	$53,275.50	30.2	19,917
TOTALS			**174,684**	**36.2**	**305.7**	**$25,271.94**	**$331,661.57**	**$22,692.60**	**$308,968.97**	**12.2**	**211,699**

* - All incentives presented in this table are based on NJ Smart Start Building equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

TOTALS (High Priority Measures)	**161,514**	**29.1**	**65.7**	**$21,540.50**	**$170,161.12**	**$14,755.00**	**$155,406.12**	**7.2**	**170,330**

Lighting Upgrades generally involve the replacement of existing lighting components such as lamps and ballasts (or the entire fixture) with higher efficiency lighting components. These measures save energy by reducing the power used by the lighting components due to improved electrical efficiency.

Lighting Controls measures generally involve the installation of automated controls to turn off lights or reduce light output when not needed. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

Motor Upgrades generally involve replacing older standard efficiency motors with high efficiency standard (NEMA Premium®). Motors replacements generally assume the same size motors, just higher efficiency. Although occasionally additional savings can be achieved by downsizing motors to better meet current load requirements. This measure saves energy by reducing the power used by the motors, due to improved electrical efficiency.

Variable Frequency Drives (VFDs) are motor control devices. These measures control the speed of a motor so that the motor spins at peak efficiency during partial load conditions. Sensors adapt the speed to flow, temperature, or pressure settings which is much more efficient that usage a valve or damper to control flow rates, or running the motor at full speed when only partial power is needed. These measures save energy by controlling motor usage more efficiently.

Electric Unitary HVAC measures generally involve replacing older inefficient air conditioning systems with modern energy efficient systems. New air conditioning systems can provide equivalent cooling to older air condition systems at a reduced energy cost. These measures save energy by reducing the power used by the air conditioning systems, due to improved electrical efficiency.

Electric Chiller measures generally involve replacing older inefficient hydronic chillers with modern energy efficient systems. New chillers can provide equivalent cooling compared to older chillers at a reduced energy cost. These measures save energy by reducing chiller energy usage, due to improved electrical and heat transfer efficiency.

Gas Heating (HVAC/Process) measures generally involve replacing older inefficient hydronic heating systems with modern energy efficient systems. Gas heating systems can provide equivalent heating compared to older systems at a reduced energy cost. These measures save energy by reducing the fuel demands for heating, due to improved combustion and heat transfer efficiency.

Domestic Hot Water upgrade measures generally involve replacement of older inefficient domestic hot water systems with modern high efficiency water heating equipment, or adding devices that conserve water and reduce hot water energy usage. High efficiency hot water heating systems and water conservation devices can provide equivalent, or greater, hot water service compared to older systems with high flow fixtures at a reduced energy cost. These measures save energy by reducing the fuel used for domestic hot water heating due to improved heating efficiency, and/or reducing standby losses by cutting excessive use of hot water.

Plug Load Equipment control measures generally involve installing automated devices that limit the power usage or operation of equipment that is plugged into an electric outlet when not in use.

Energy Efficient Practices

TRC also identified 16 low-cost (or no-cost) energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral or operational adjustments and by performing better routine maintenance on building systems. These practices can extend equipment lifetime, improve occupant comfort, provide better health and safety, as well as reduce annual energy and operation and maintenance costs (O&M). Potential opportunities identified at the Water Works include:

- Reduce Air Leakage
- Close Doors and Windows
- Use Window Treatments/Coverings
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Perform Routine Motor Maintenance
- Use Fans to Reduce Cooling Load
- Practice Proper Use of Thermostat Schedules and Temperature Resets
- Assess Chillers & Request Tune-Ups
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Check for and Seal Duct Leakage
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- Water Conservation

For details on these energy efficient practices, please refer to Section 5.

On-Site Generation Measures

TRC evaluated the potential for installing on-site generation for the Water Works facility on the roof top of the truck bay garage. Based on the configuration of the site and its loads there is a high potential for installing a photovoltaic (PV) array.

Potential	High	
System Potential	53	kW DC STC
Electric Generation	63,143	kWh/yr
Displaced Cost	$5,490	/yr
Installed Cost	$137,800	

For details on our evaluation and on-site generation potential, please refer to Section 6.

1.3 Implementation Planning

To realize the energy savings from the ECMs listed in this report, a project implementation plan must be developed. Available capital must be considered and decisions need to be made whether it is best to pursue individual ECMs separately, groups of ECMs, or a comprehensive approach where all ECMs are implemented together, possibly in conjunction with other facility upgrades or improvements.

Rebates, incentives, and financing are available from NJCEP, as well as other sources, to help reduce the costs associated with the implementation of energy efficiency projects. Prior to implementing any measure, please review the relevant incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives prior to purchasing materials or commencing with installation.

The ECMs outlined in this report may qualify under the following program(s):

- SmartStart
- Direct Install
- SREC (Solar Renewable Energy Certificate) Registration Program (SRP)
- Energy Savings Improvement Program (ESIP)

For facilities wanting to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the SmartStart program. To participate in this program you may utilize internal resources, or an outside firm or contractor, to do the final design of the ECM(s) and do the installation. Program pre-approval is required for some SmartStart incentives, so only after receiving pre-approval should you proceed with ECM installation. The incentive estimates listed above in Figure 4 are based on the SmartStart program. More details on this program and others are available in Section 8.

This facility may also qualify for the Direct Install program which can provide turnkey installation of multiple measures, through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70% of the cost of selected measures, although measure eligibility will have to be assessed and be verified by the designated Direct Install contractor and, in most cases, they will perform the installation work.

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (ESIP). Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.4 for additional information on the ESIP Program.

The Demand Response Energy Aggregator is a (non-NJCEP) program designed to reduce electric loads at commercial facilities, when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak power demand. Demand Response (DR) service providers (a.k.a. Curtailment Service Providers) are registered with PJM, the independent system operator (ISO) for mid-Atlantic state region that is charged with maintaining electric grid reliability. By enabling grid operators to call upon commercial facilities to reduce their electric usage during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment Service Providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary and facilities receive payments whether or not they are called upon to curtail their load during times of peak demand. Refer to Section 7 for additional information on this program.

Additional information on relevant incentive programs is located in Section 8. You may also check the following website for more details: www.njcleanenergy.com/ci.

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 5 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Hoggarth Stephen	Principal Engineer	hstephen@trentonnj.org	609-989-3615
Sean Semple	Assistant Director of Public Works	ssemple@trentonnj.org	609-989-3823
Designated Representative			
Greg Adams	Head of Maintenance		609-203-1360
TRC Energy Services			
Aimee Lalonde	Auditor	alalonde@trcsolutions.com	732-855-0033

2.2 General Site Information

On February 05, 2018, TRC performed an energy audit at the Water Works located in Trenton, New Jersey. TRC's team met with Greg Adams to review the facility operations and help focus our investigation on specific energy-using systems.

Water Works is a 35,517 square foot facility comprised of office space, warehouse space and mechanic garages. The building also has exterior truck garage bays which are unconditioned but illuminated. The water works building is 100% heated and cooled by various HVAC systems and equipment. The facility has two floors and was originally built in 1958.

Lighting, heating and cooling equipment at the Water Works consists of aging and inefficient equipment that was evaluated for replacement. However some of these measures are cost prohibitive. The lighting in the hallways has recently been updated to LEDs, and an upgrade for office areas is scheduled to start soon. The remainder of lighting is a mixture of compact fluorescent, linear fluorescent and HID technologies. There is a hydronic heating system that is served by a hot water boiler which is in poor condition and nearing 30 years old. There is a chilled water cooling system that is served by a chiller that is in poor condition and also nearing 30 years old. The roof needs replacement and has leaks in certain areas. With the exception of lighting, major upgrades to the heating and cooling systems as well as the roof do not meet the program's protocols for recommendation based on energy savings alone. The roof replacement should be completed as a capital improvement measure. The boiler and chiller replacements should be considered for implementation if the City of Trenton pursues the Energy Savings Improvement Program (ESIP). More information provided within Section 8.

2.3 Building Occupancy

The facility is in operation year-round with operating hours Monday through Friday between 8:00 AM and 4:30 PM with cleaning performed after hours. There is a stand by crew that occupies the building on weekends between 4:30 PM and 9:00 PM, with a higher number of staff in the winter in comparison to the summer. On average, the building is occupied by about 250 people. The typical schedule is presented in the table below.

Figure 6 – Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Water Works	Weekday	8:00 AM to 4:30 PM
Water Works	Weekend	Stand By Crew Only

2.4 Building Envelope

The building is constructed of concrete block and structural steel with a brick facade. The building has flat roof sections with a rock finish, in poor condition. The buildings have double pane operable windows which are in good condition and show little signs of excessive infiltration at the metal frames. The exterior doors are constructed of aluminum and in good condition except that the door seals have worn out which increases the level of outside air infiltration. In the mechanic shop and garage areas, there are overhead doors which also have worn out seals.

Building Envelope

2.5 On-Site Generation

The Water Works facility does not currently have any on-site electric generation capacity.

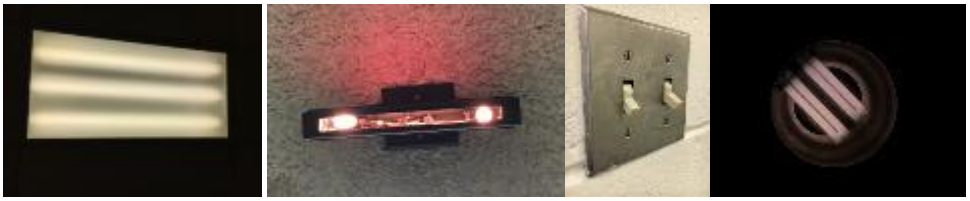
2.6 Energy-Using Systems

Please see Appendix A: Equipment Inventory & Recommendations for an inventory of the facility's equipment.

Lighting System

Lighting at the facility is provided mostly by 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as some compact fluorescent lamp (CFL) recessed can fixtures. Most of the fixtures are 2-lamp or 3-lamp, 4-foot long troffers with diffusers or industrial fixtures within storage warehouse areas.

Facility maintenance staff have indicated that the building has begun a T8 retrofit to LED project in hallways and will continue in office areas. There are many exit signs throughout the facility lit by incandescent lamps. The mechanics shop and truck garage bay are illuminated by high bay HID fixtures.



Sample Lighting and Controls

Comparison in light quality, T8 vs LED in Hallways ***Office T8 lighting***

Warehouse T8 lighting and Mechanic's Shop HID lighting

Lighting control for most areas is provided by wall switches. There is an opportunity for energy savings by upgrading fluorescent to LED technology and installing occupancy-based sensors where applicable.

The building's exterior lighting is provided by HID wall pack fixtures, HID pole mounted walkway post top fixtures. The parking lot areas are lit by pole mounted HID lamp fixtures. These exterior light fixtures are controlled by time clocks. There is an opportunity for energy savings by upgrading these to LED technology.

Exterior HID lighting (Building Mounted and Pole Mounted)

Exterior HID lighting in Garage Bays (Wall Mounted Floods and Surface Mounted Canopy)

Motors

The HVAC systems within the facility include the use of motors. A majority of the building system motors are fractional horsepower and, if visible, were noted to be in fair to good condition. These include the water supply pump, unitary HVAC equipment fans, exhaust fans, and secondary chilled water loop pumping.

The hydronic heating system includes the use of two 5 HP standard efficiency hot water pumps motors which are in poor condition. The chilled water cooling system uses two 5 HP standard efficiency motors for the chilled water primary distribution loop. They are also in poor condition.

Hot water and chilled water pumps operate at constant speed as needed. There is an opportunity for energy savings by upgrading these 5 HP motors with premium efficient motors and installing variable frequency drives.

Heating hot water pump motors

Chilled water pump motors

Chilled Water Systems

The facility's cooling system is served by two Trane R-22 roof mounted air-cooled packaged scroll chillers, a 15-ton unit and a 40-ton unit. They are of standard efficiency and in poor condition. At 30 years old, they are at the end of their useful life. The chillers are configured in a primary- secondary distribution loop with two 5 HP constant flow primary pumps and two ¾ HP constant flow secondary pumps. Chilled water is distributed to cooling coils located in unitary HVAC equipment based on a reset schedule.

Air Cooled Scroll Chillers

Hot Water Heating System

The hot water system consists of a gas fired non-condensing Weil McLain hot water boiler with an output capacity of 1,358 kBtu/hr and a nominal combustion efficiency of 80%. The boiler is in poor condition and nearing the end of its useful life at 30 years. The boiler burner motor is ½ HP. The boiler provides hot water through constant flow primary distribution two 5 HP hot water pumps. Hot water is supplied at 180°F when the outside air temperature is below 50°F and the set point. We could not determine whether the supply water temperature is reset by the available information. The boilers provide hot water to HVAC units throughout the building.

Hot Water Boiler

Ceiling PTAC and Basic Manual Dial Thermostat Control

Air Handling Unit for Locker Room

Electric HVAC Equipment

There are split AC systems which serve office space and are in fair condition. There are also packaged terminal heat pumps as well as cabinet unit heaters in hallway areas. The units are controlled by individual thermostats that are manually set.

Split AC Systems

Terminal PTAC and Cabinet Unit Heater

Domestic Hot Water Heating System

The domestic hot water heating system for the facility consists of a gas-fired storage tank water heater that is five years old with an input rating of 250 kBtu/hr and a nominal efficiency of 80%. The water heater has an 80-gallon storage tank capacity and is in good condition. A fractional horsepower motor driven recirculation pump distributes 130°F water to restrooms throughout the facility and these operate as needed.

DHW Heater, Circulation Motor and High Flow Faucet Aerator

Building Plug Load

There are stand-up refrigerators in lounge areas of the building which were mostly noted to be 90% empty at the time of the audit. We recommend consolidating contents and removing unneeded refrigerators from use. There is also an ice maker in the lounge. The plug loads in the facility include general office and café equipment. There are roughly 59 computers throughout the facility. There is no centralized PC power management software installed. The lounge areas have snack and refrigerated beverage vending machines which are currently in operation 24 hours a day, seven days a week without control.

2.7 Water-Using Systems

The restrooms at this facility include faucets which are currently fit with higher flow aerators, 2.0 and 2.2 gallon per minute (gpm). These may be replaced with low flow devices to save both water and energy use associated with producing domestic hot water.

3 SITE ENERGY USE AND COSTS

Utility data for electricity and natural gas was analyzed to identify opportunities for savings. In addition, data for electricity and natural gas was evaluated to determine the annual energy performance metrics for the building in energy cost per square foot and energy usage per square foot. These metrics are an estimate of the relative energy efficiency of this building. There are a number of factors that could cause the energy use of this building to vary from the "typical" energy usage profile for facilities with similar characteristics. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and energy efficient behavior of occupants all contribute to benchmarking scores. Please refer to the Benchmarking section within Section 3.4 for additional information.

3.1 Total Cost of Energy

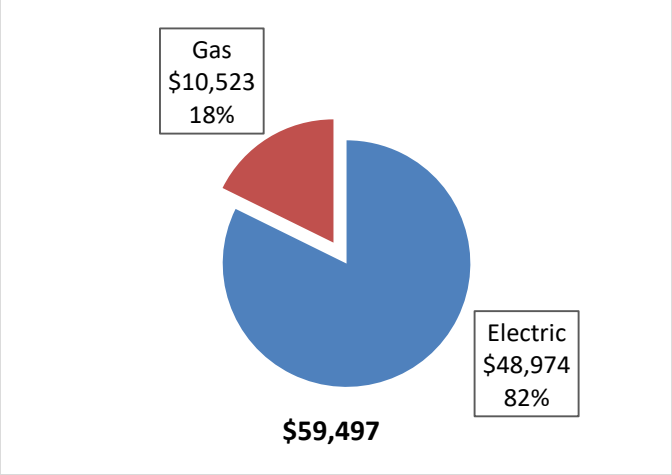
The following energy consumption and cost data is based on a recent 12-month period of utility billing data which was provided by the customer for each utility serving the facility. A profile of the facility's annual energy consumption and cost was developed from this data.

Figure 7 - Utility Summary

Utility Summary for Water Works		
Fuel	**Usage**	**Cost**
Electricity	376,880 kWh	$48,974
Natural Gas	12,505 Therms	$10,523
Total		**$59,497**

The current annual energy cost for this facility is $59,497 as shown in the chart below.

Figure 8 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric rate over a recent 12-month period was $0.130/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The electrical demand has costs associated with it and are roughly $4.40/kW year-round with an additional $8.17/kW in the summer months. The monthly electricity consumption and peak demand are shown in the chart below. The chart reflects a slight increase of use in summer months to reflect the additional cooling during this period.

Figure 9 - Electric Usage & Demand

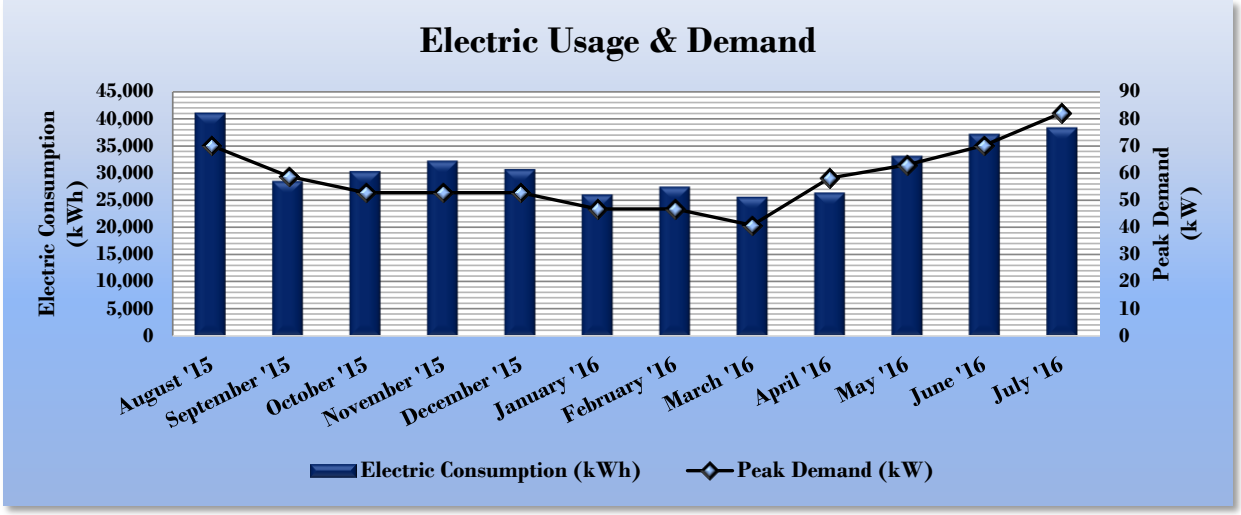


Figure 10 - Electric Usage & Demand

Electric Billing Data for Water Works					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
9/14/15	32	41,040	70		$5,789
10/13/15	29	28,520	59		$3,612
11/12/15	30	30,300	53		$3,656
12/14/15	32	32,220	53		$3,806
1/14/16	31	30,660	53		$3,670
2/12/16	29	26,040	47		$3,245
3/15/16	32	27,480	47		$3,385
4/14/16	30	25,620	41		$3,239
5/13/16	29	26,400	58		$3,315
6/14/16	32	33,120	63		$4,658
7/14/16	30	37,140	70		$5,219
8/12/16	29	38,340	82		$5,380
Totals	**365**	**376,880**	**82.2**	**$0**	**$48,974**
Annual	**365**	**376,880**	**82.2**	**$0**	**$48,974**

3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average natural gas rate over a recent 12 month period was found to be $0.842/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below. The graph is typical of a site that uses natural gas primarily for space heating.

Figure 11 - Natural Gas Usage

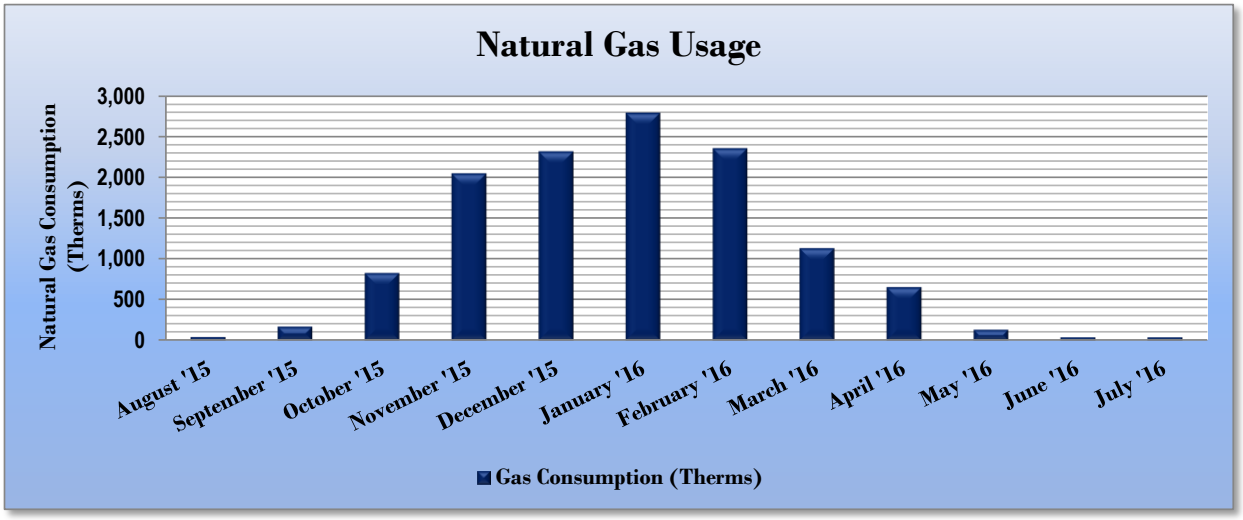


Figure 12 - Natural Gas Usage

Gas Billing Data for Water Works			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
9/14/15	32	40	$128
10/13/15	29	169	$198
11/12/15	30	824	$999
12/14/15	32	2,043	$1,729
1/14/16	31	2,311	$1,932
2/12/16	29	2,784	$2,192
3/15/16	32	2,349	$1,811
4/14/16	30	1,129	$664
5/13/16	29	652	$439
6/14/16	32	131	$175
7/14/16	30	38	$128
8/12/16	29	35	$128
Totals	**365**	**12,505**	**$10,523**
Annual	**365**	**12,505**	**$10,523**

3.4 Benchmarking

This facility was benchmarked using Portfolio Manager®, an online tool created and managed by the United States Environmental Protection Agency (EPA) through the ENERGY STAR® program. Portfolio Manager® analyzes your building's consumption data, cost information, and operational use details and then compares its performance against a national median for similar buildings of its type. Metrics provided by this analysis are Energy Use Intensity (EUI) and an ENERGY STAR® score for select building types.

The EUI is a measure of a facility's energy consumption per square foot, and it is the standard metric for comparing buildings' energy performance. Comparing the EUI of a building with the national median EUI for that building type illustrates whether that building uses more or less energy than similar buildings of its type on a square foot basis. EUI is presented in terms of "site energy" and "source energy." Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

Figure 13 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Water Works	National Median Building Type: Office
Source Energy Use Intensity (kBtu/ft^2)	150.7	148.1
Site Energy Use Intensity (kBtu/ft^2)	71.4	67.3

Implementation of all recommended measures in this report would improve the building's estimated EUI significantly, as shown in the table below:

Figure 14 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Water Works	National Median Building Type: Office
Source Energy Use Intensity (kBtu/ft^2)	100.0	148.1
Site Energy Use Intensity (kBtu/ft^2)	54.0	67.3

Many types of commercial buildings are also eligible to receive an ENERGY STAR® score. This score is a percentile ranking from 1 to 100. It compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide and may be eligible for ENERGY STAR® certification. Your building currently has a score of 73.

A Portfolio Manager® Statement of Energy Performance (SEP) was generated for this facility, see Appendix B: ENERGY STAR® Statement of Energy Performance.

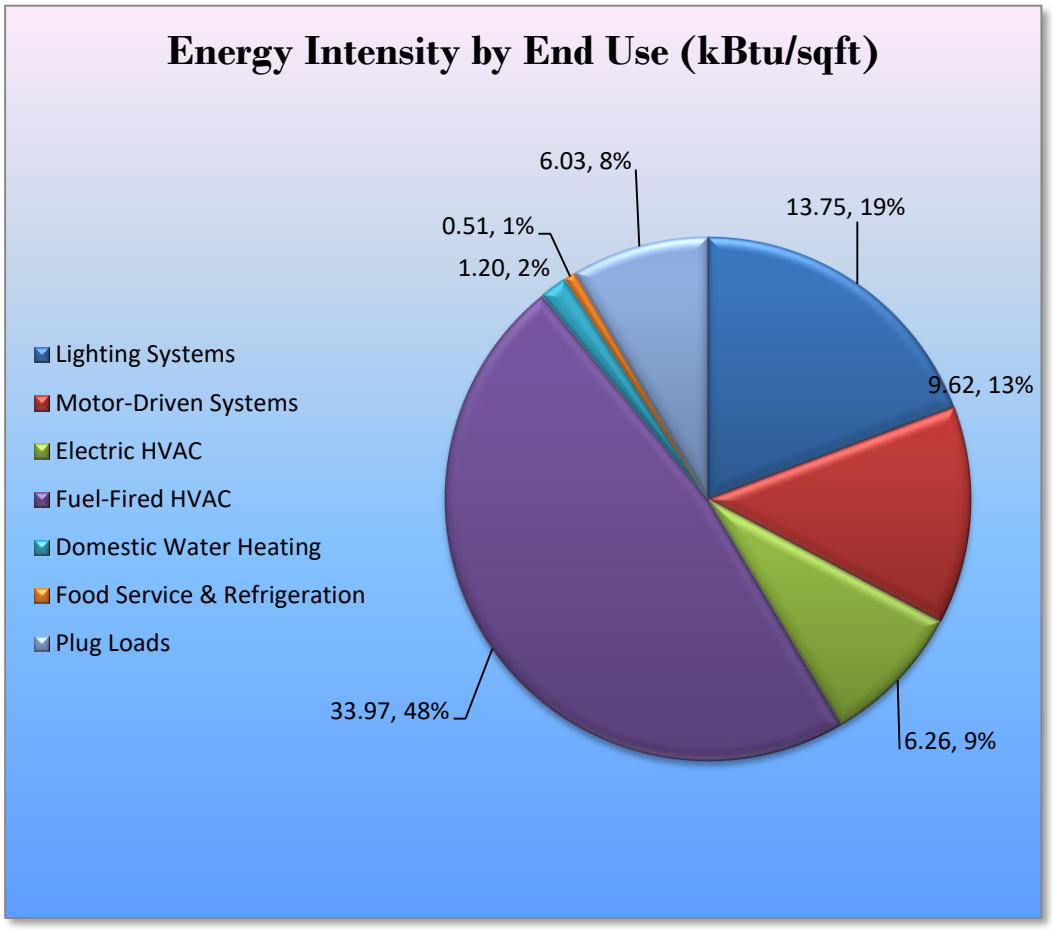
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

A Portfolio Manager® account has been created online for your facility and you will be provided with the login information for the account. We encourage you to update your utility information in Portfolio Manager® regularly, so that you can keep track of your building's performance. Free online training is available to help you use ENERGY STAR® Portfolio Manager® to track your building's performance at: https://www.energystar.gov/buildings/training.

3.5 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across building systems, an energy balance was performed at this facility. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building to determine their proportional contribution to overall building energy usage. This chart of energy end uses highlights the relative contribution of each equipment category to total energy usage. This can help determine where the greatest benefits might be found from energy efficiency measures.

Figure 15 - Energy Balance (% and kBtu/SF)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the Water Works regarding financial incentives for which they may qualify to implement the recommended measures. For this audit report, most measures have received only a preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to demonstrate project cost-effectiveness and help prioritize energy measures. Savings are based on the New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016, approved by the New Jersey Board of Public Utilities. Further analysis or investigation may be required to calculate more precise savings based on specific circumstances. A higher level of investigation may be necessary to support any custom SmartStart or Pay for Performance, or Direct Install incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJCEP prescriptive SmartStart program. Some measures and proposed upgrade projects may be eligible for higher incentives than those shown below through other NJCEP programs as described in Section 8.

The following sections describe the evaluated measures.

4.1 Recommended ECMs

The measures below have been evaluated by the auditor and are recommended for implementation at the facility.

Figure 16 – Summary of Recommended ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**98,493**	**17.8**	**0.0**	**$12,798.73**	**$99,816.01**	**$12,345.00**	**$87,471.01**	**6.8**	**99,181**
ECM 1	Install LED Fixtures	52,618	5.4	0.0	$6,837.55	$67,826.44	$6,725.00	$61,101.44	8.9	52,986
ECM 2	Retrofit Fixtures with LED Lamps	43,005	12.1	0.0	$5,588.26	$29,838.47	$5,620.00	$24,218.47	4.3	43,305
ECM 3	Install LED Exit Signs	2,870	0.2	0.0	$372.92	$2,151.10	$0.00	$2,151.10	5.8	2,890
Lighting Control Measures		**10,359**	**2.9**	**0.0**	**$1,346.05**	**$9,608.00**	**$1,030.00**	**$8,578.00**	**6.4**	**10,431**
ECM 4	Install Occupancy Sensor Lighting Controls	10,359	2.9	0.0	$1,346.05	$9,608.00	$1,030.00	$8,578.00	6.4	10,431
Motor Upgrades		**2,221**	**0.5**	**0.0**	**$288.62**	**$3,201.48**	**$0.00**	**$3,201.48**	**11.1**	**2,237**
ECM 5	Premium Efficiency Motors	2,221	0.5	0.0	$288.62	$3,201.48	$0.00	$3,201.48	11.1	2,237
Variable Frequency Drive (VFD) Measures		**23,006**	**2.5**	**0.0**	**$2,989.51**	**$13,103.40**	**$0.00**	**$13,103.40**	**4.4**	**23,167**
ECM 6	Install VFDs on Chilled Water Pumps	10,163	1.3	0.0	$1,320.60	$6,551.70	$0.00	$6,551.70	5.0	10,234
ECM 7	Install VFDs on Hot Water Pumps	12,843	1.3	0.0	$1,668.90	$6,551.70	$0.00	$6,551.70	3.9	12,933
Electric Unitary HVAC Measures		**15,193**	**5.4**	**0.0**	**$1,974.32**	**$35,987.70**	**$1,380.00**	**$34,607.70**	**17.5**	**15,300**
ECM 8	Install High Efficiency Heat Pumps	15,193	5.4	0.0	$1,974.32	$35,987.70	$1,380.00	$34,607.70	17.5	15,300
Domestic Water Heating Upgrade		**0**	**0.0**	**17.4**	**$146.39**	**$64.53**	**$0.00**	**$64.53**	**0.4**	**2,037**
ECM 9	Install Low-Flow Domestic Hot Water Devices	0	0.0	17.4	$146.39	$64.53	$0.00	$64.53	0.4	2,037
Plug Load Equipment Control - Vending Machine		**3,224**	**0.0**	**0.0**	**$418.90**	**$460.00**	**$0.00**	**$460.00**	**1.1**	**3,246**
ECM 10	Vending Machine Control	3,224	0.0	0.0	$418.90	$460.00	$0.00	$460.00	1.1	3,246
Custom Measures		**9,018**	**0.0**	**48.3**	**$1,577.98**	**$7,920.00**	**$0.00**	**$7,920.00**	**5.0**	**14,732**
ECM 11	Computer Power Management Software	8,873	0.0	0.0	$1,152.99	$3,385.00	$0.00	$3,385.00	2.9	8,935
ECM 12	Building Envelope Weatherization	145	0.0	48.3	$424.99	$4,535.00	$0.00	$4,535.00	10.7	5,797
TOTALS		**161,514**	**29.1**	**65.7**	**$21,540.50**	**$170,161.12**	**$14,755.00**	**$155,406.12**	**7.2**	**170,330**

* - All incentives presented in this table are based on NJ Smart Start Building equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

4.1.1 Lighting Upgrades

Our recommendations for upgrades to existing lighting fixtures are summarized in Figure 17 below.

Figure 17 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**98,493**	**17.8**	**0.0**	**$12,798.73**	**$99,816.01**	**$12,345.00**	**$87,471.01**	**6.8**	**99,181**
ECM 1	Install LED Fixtures	52,618	5.4	0.0	$6,837.55	$67,826.44	$6,725.00	$61,101.44	8.9	52,986
ECM 2	Retrofit Fixtures with LED Lamps	43,005	12.1	0.0	$5,588.26	$29,838.47	$5,620.00	$24,218.47	4.3	43,305
ECM 3	Install LED Exit Signs	2,870	0.2	0.0	$372.92	$2,151.10	$0.00	$2,151.10	5.8	2,890

During lighting upgrade planning and design, we recommend a comprehensive approach that considers both the efficiency of the lighting fixtures and how they are controlled.

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	20,978	5.4	0.0	$2,726.07	$44,531.20	$3,800.00	$40,731.20	14.9	21,125
Exterior	31,640	0.0	0.0	$4,111.49	$23,295.24	$2,925.00	$20,370.24	5.0	31,861

Measure Description

We recommend replacing existing interior high bay fixtures containing HID lamps with new reduced wattage high performance LED light fixtures. This also includes replacing surface mounted HID lamp canopy fixtures in the truck garage bay with reduced wattage high performance LED light fixtures.

This measure includes the replacement of existing exterior HID fixtures in the walkway and parking lot as well as the shoe box pole mounted fixtures at the pump station and the building mounted HID wall pack fixtures. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output. Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes are much longer than traditional HID technologies.

ECM 2: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	42,558	12.1	0.0	$5,530.25	$29,730.97	$5,610.00	$24,120.97	4.4	42,856
Exterior	446	0.0	0.0	$58.01	$107.51	$10.00	$97.51	1.7	450

Measure Description

We recommend retrofitting existing incandescent, compact fluorescent and linear fluorescent fixtures with LED lamps. Many LED tube lamps are direct replacements for existing fluorescent lamps and can be installed while leaving the fluorescent fixture ballast in place. LED bulbs can be used in existing fixtures as a direct replacement for most other lighting technologies. This measure saves energy by installing LEDs which use less power than other lighting technologies yet provide equivalent lighting output for the space. Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes which are more than twice that of fluorescent tubes and more than ten times longer than many incandescent lamps.

ECM 3: Install LED Exit Signs

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	2,870	0.2	0.0	$372.92	$2,151.10	$0.00	$2,151.10	5.8	2,890
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend replacing all incandescent exit signs with LED exit signs. LED exit signs require virtually no maintenance and have a life expectancy of at least 20 years. This measure saves energy by installing LED fixtures, which use less power than other technologies with an equivalent lighting output.

4.1.2 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 18 below.

Figure 18 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**10,359**	**2.9**	**0.0**	**$1,346.05**	**$9,608.00**	**$1,030.00**	**$8,578.00**	**6.4**	**10,431**
ECM 4	Install Occupancy Sensor Lighting Controls	10,359	2.9	0.0	$1,346.05	$9,608.00	$1,030.00	$8,578.00	6.4	10,431

During lighting upgrade planning and design, we recommend a comprehensive approach that considers both the efficiency of the lighting fixtures and how they are controlled.

ECM 4: Install Occupancy Sensor Lighting Controls

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
10,359	2.9	0.0	$1,346.05	$9,608.00	$1,030.00	$8,578.00	6.4	10,431

Measure Description

We recommend installing occupancy sensors to control lighting fixtures that are currently controlled by manual switches in many offices, locker rooms, storage/warehouse areas rooms, lobby and back hallways as well as lounge areas. Lighting sensors detect occupancy using ultrasonic and/or infrared sensors. For most spaces, we recommend lighting controls use dual technology sensors, which can eliminate the possibility of any lights turning off unexpectedly. Lighting systems are enabled when an occupant is detected. Fixtures are automatically turned off after an area has been vacant for a preset period. Some controls also provide dimming options and all modern occupancy controls can be easily over-ridden by room occupants to allow them to manually turn fixtures on or off, as desired. Energy savings results from only operating lighting systems when they are required.

Occupancy sensors may be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. In general, wall switch replacement sensors are recommended for single occupant offices and other small rooms. Ceiling-mounted or remote mounted sensors are used in locations without local switching or where wall switches are not in the line-of-sight of the main work area and in large spaces. We recommend a comprehensive approach to lighting design that upgrades both the lighting fixtures and the controls together for maximum energy savings and improved lighting for occupants.

4.1.3 Motor Upgrades

Our recommendations for motor upgrade measures are summarized in Figure 19 below.

Figure 19 - Summary of Motor Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Motor Upgrades		**2,221**	**0.5**	**0.0**	**$288.62**	**$3,201.48**	**$0.00**	**$3,201.48**	**11.1**	**2,237**
ECM 5	Premium Efficiency Motors	2,221	0.5	0.0	$288.62	$3,201.48	$0.00	$3,201.48	11.1	2,237

ECM 5: Premium Efficiency Motors

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
2,221	0.5	0.0	$288.62	$3,201.48	$0.00	$3,201.48	11.1	2,237

Measure Description

We recommend replacing standard efficiency hot water and chilled water primary pump motors with NEMA Premium® efficiency motors. Our evaluation assumes that existing motors will be replaced with motors of equivalent size and type. Although occasionally additional savings can be achieved by downsizing motors to better meet the motor's current load requirements. The base case motor efficiencies are estimated from nameplate information and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the *New Jersey's Clean Energy Program Protocols to Measure Resource Savings (2016)*. Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours.

4.1.4 Variable Frequency Drive Measures

Our recommendations for variable frequency drive (VFD) measures are summarized in Figure 20 below.

Figure 20 – Summary of Variable Frequency Drive ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**23,006**	**2.5**	**0.0**	**$2,989.51**	**$13,103.40**	**$0.00**	**$13,103.40**	**4.4**	**23,167**
ECM 6	Install VFDs on Chilled Water Pumps	10,163	1.3	0.0	$1,320.60	$6,551.70	$0.00	$6,551.70	5.0	10,234
ECM 7	Install VFDs on Hot Water Pumps	12,843	1.3	0.0	$1,668.90	$6,551.70	$0.00	$6,551.70	3.9	12,933

ECM 6: Install VFDs on Chilled Water Pumps

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
10,163	1.3	0.0	$1,320.60	$6,551.70	$0.00	$6,551.70	5.0	10,234

Measure Description

We recommend installing a variable frequency drives (VFD) to control primary loop chilled water pumps. This measure requires that chilled water coils be served by 2-way valves and that a differential pressure sensor be installed in the chilled water loop. As the chilled water valves close, the differential pressure increases. The VFD modulates pump speed to maintain a differential pressure setpoint. Energy savings results from reducing pump motor speed (and power) as chilled water valves close. The magnitude of energy savings is based on the estimated amount of time that the system operates at reduced loads.

For systems with variable chilled water flow through the chiller, the minimum flow to prevent the chiller from tripping off will have to be determined during the final project design. The control system should be programmed to maintain the minimum flow through the chiller and to prevent pump cavitation.

ECM 7: Install VFDs on Hot Water Pumps

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
12,843	1.3	0.0	$1,668.90	$6,551.70	$0.00	$6,551.70	3.9	12,933

Measure Description

We recommend installing variable frequency drives (VFD) to control the hot water pumps. This measure requires that a majority of the hot water coils be served by 2-way valves and that a differential pressure sensor is installed in the hot water loop. As the hot water valves close, the differential pressure increases. The VFD modulates pump speed to maintain a differential pressure setpoint. Energy savings results from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

4.1.5 Electric Unitary HVAC Measures

Our recommendations for unitary HVAC measures are summarized in Figure 21 below.

Figure 21 - Summary of Unitary HVAC ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		**15,193**	**5.4**	**0.0**	**$1,974.32**	**$35,987.70**	**$1,380.00**	**$34,607.70**	**17.5**	**15,300**
ECM 8	Install High Efficiency Heat Pumps	15,193	5.4	0.0	$1,974.32	$35,987.70	$1,380.00	$34,607.70	17.5	15,300

ECM 8: Install High Efficiency Heat Pumps

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
15,193	5.4	0.0	$1,974.32	$35,987.70	$1,380.00	$34,607.70	17.5	15,300

Measure Description

We recommend replacing standard efficiency heat pumps with high efficiency heat pumps. There have been significant improvements in both compressor and fan motor efficiencies over the past several years. Therefore, electricity savings can be achieved by replacing older units with new high efficiency units. A higher EER or SEER rating indicates a more efficient cooling system and a higher HPSF rating indicates more efficient heating mode. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average heating and cooling loads, and the estimated annual operating hours.

4.1.6 Domestic Hot Water Heating System Upgrades

Our recommendations for domestic water heating system improvements are summarized in Figure 22 below.

Figure 22 - Summary of Domestic Water Heating ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**17.4**	**$146.39**	**$64.53**	**$0.00**	**$64.53**	**0.4**	**2,037**
ECM 9	Install Low-Flow Domestic Hot Water Devices	0	0.0	17.4	$146.39	$64.53	$0.00	$64.53	0.4	2,037

ECM 9: Install Low-Flow DHW Devices

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
0	0.0	17.4	$146.39	$64.53	$0.00	$64.53	0.4	2,037

Measure Description

We recommend installing low-flow domestic hot water devices to reduce overall hot water demand. Energy demand from domestic hot water heating systems can be reduced by reducing water usage in general. Faucet aerators can reduce hot water usage, relative to standard aerators, which saves energy. Low-flow devices reduce the overall water flow from the fixture, while still adequate pressure for washing. This reduces the amount of water used per day resulting in energy and water savings.

4.1.7 Plug Load Equipment Control - Vending Machines

Our recommendations for plug load equipment measures are summarized in Figure 23 below.

Figure 23 - Summary of Plug Load Equipment Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine		**3,224**	**0.0**	**0.0**	**$418.90**	**$460.00**	**$0.00**	**$460.00**	**1.1**	**3,246**
ECM 10	Vending Machine Control	3,224	0.0	0.0	$418.90	$460.00	$0.00	$460.00	1.1	3,246

ECM 10: Vending Machine Control

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
3,224	0.0	0.0	$418.90	$460.00	$0.00	$460.00	1.1	3,246

Measure Description

Vending machines operate continuously, even during non-business hours. It is recommended to install occupancy sensor controls for refrigerated vending machines to reduce the energy use. These controls power down vending machines when the vending machine area has been vacant for some time, then power up at regular intervals, as needed, to turn machine lights on or keep the product cool. Energy savings are a dependent on vending machine and activity level in the area surrounding the machines.

4.1.8 Custom Measures

Additional custom measure energy saving opportunities are addressed in this section. Recommended custom measures are summarized in Figure 24 below.

Figure 24 - Summary of Custom ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Custom Measures		**9,018**	**0.0**	**48.3**	**$1,577.98**	**$7,920.00**	**$0.00**	**$7,920.00**	**5.0**	**14,732**
ECM 11	Computer Power Management Software	8,873	0.0	0.0	$1,152.99	$3,385.00	$0.00	$3,385.00	2.9	8,935
ECM 12	Building Envelope Weatherization	145	0.0	48.3	$424.99	$4,535.00	$0.00	$4,535.00	10.7	5,797

ECM 11: Computer Power Management Software

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
8,873	0.0	0.0	$1,152.99	$3,385.00	$0.00	$3,385.00	2.9	8,935

Measure Description

We recommend the implementation of computer power management software. The computing environment in most office facilities includes desktops, which are typically left on over nights, weekends and holidays. Screen savers are commonly confused as a power management strategy. This contributes to excessive electrical energy consumption, which may be avoided by proper management.

There are innovative software packages available in the market today that are designed to deliver significant energy saving and provide ongoing tracking measurements. Operational and maintenance benefits are captured through the use of a central power management platform where issues may be diagnosed and problematic devices may be isolated. Energy savings policies may be enforced as well as identifying and eliminating underutilized devices.

This measure investigates the potential benefits to implementing computer power management software to better match the energy use to user needs. The image to the right is for demonstration purposes only and represents the difference between potential duration of devices being in Power-On States vs. the duration of User Activity. This difference provides an opportunity for energy savings by implementing power management software.

ECM 12: Building Envelope Weatherization

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
145	0.0	48.3	$424.99	$4,535.00	$0.00	$4,535.00	10.7	5,797

Measure Description

We recommend weather-stripping the exterior doors throughout the building. These were noted to have missing or worn weather-stripping with clear air gaps. We also recommend the caulking of window frames. Building envelopes that limit air infiltration and that have adequate insulation play a key role in optimizing heating and cooling efficiency, controlling moisture, and providing occupant comfort. Cracks and gaps throughout your building – around windows and doors, through utility openings, at the foundation and roof – may not seem significant, but their effects add up. Reducing uncontrolled air infiltration through air sealing is a cost effective way to improve the performance and energy efficiency of your facility. The proper sealing of sources for air infiltration and exfiltration will mitigate the air through the building and thus reduce the load on the facility's heating and cooling equipment. Exterior doors should be properly weather-stripped which may include the installation of a bottom sweep, center sweep and weather-stripping around the perimeter of the door.

4.2 ECMs Evaluated But Not Recommended

The measures below have been evaluated by the auditor but are not recommended for implementation at the facility. Reasons for exclusion can be found in each measure description section.

Figure 25 – Summary of Measures Evaluated, But Not Recommended

Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Chiller Replacement	**7,419**	**7.1**	**0.0**	**$964.10**	**$75,628.30**	**$4,950.00**	**$70,678.30**	**73.3**	**7,471**
Install High Efficiency Chillers	7,419	7.1	0.0	$964.10	$75,628.30	$4,950.00	$70,678.30	73.3	7,471
Gas Heating (HVAC/Process) Replacement	**0**	**0.0**	**119.4**	**$1,004.82**	**$32,596.65**	**$2,987.60**	**$29,609.05**	**29.5**	**13,981**
Install High Efficiency Hot Water Boilers	0	0.0	119.4	$1,004.82	$32,596.65	$2,987.60	$29,609.05	29.5	13,981
Custom Measures	**5,751**	**0.0**	**120.6**	**$1,762.52**	**$53,275.50**	**$0.00**	**$53,275.50**	**30.2**	**19,917**
Installation of an Energy Management System	5,751	0.0	120.6	$1,762.52	$53,275.50	$0.00	$53,275.50	30.2	19,917
TOTALS	**13,170**	**7.1**	**240.1**	**$3,731.44**	**$161,500.45**	**$7,937.60**	**$153,562.85**	**41.2**	**41,369**

* - All incentives presented in this table are based on NJ Smart Start Building equipment incentives and assume proposed equipment meets minimum performance criteria for that program.

** - Simple Payback Period is based on net measure costs (i.e. after incentives).

Install High Efficiency Chillers

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
7,419	7.1	0.0	$964.10	$75,628.30	$4,950.00	$70,678.30	73.3	7,471

Measure Description

We recommend replacing older inefficient electric chillers with new high efficiency chillers. The type of chiller to be installed depends on the magnitude of the cooling load and variability of the cooling load profile. Positive displacement chillers are usually under 600 tons of cooling capacity and centrifugal chillers generally start at 150 tons of cooling capacity. Constant speed chillers should be used to meet cooling loads with little or no variation while variable speed chillers are more efficient for variable cooling load profiles. Water cooled chillers are more efficient than air cooled chillers but require cooling towers and additional pumps to circulate the cooling water. In any given size range variable speed chillers tend to have better partial load efficiency, but worse full load efficiency, than constant speed chillers.

The savings result from the improvement in chiller efficiency and matching the right type of chiller to the cooling load. The energy savings associated with this measure is based on the cooling capacity of the new chiller, the improvement in efficiency compared with the base case equipment, the cooling load profile, and the estimated annual operating hours of the chiller before and after the upgrade. Energy savings are maximized by proper selection of new equipment based on the cooling load profile.

Reasons for not Recommending

This measure is cost prohibitive. Replacement of these units now is not recommended on the basis of energy savings alone because the payback period for replacing them exceeds the useful life of the equipment. However, this measure was evaluated to demonstrate the potential savings by upgrading to high efficiency equipment. This analysis may be beneficial to support justification for implementation based on other benefits such as improved occupant comfort and operational and maintenance benefits.

For very old equipment which is reaching the end of its useful life, replacement cannot be justified solely on energy savings. However, in order to reduce operational and maintenance specific issues such as getting replacement parts, equipment reliability and redundancy – this measure evaluation was provided for demonstration purposes only. This measure may be implemented as more of a capital improvement project that may be rolled into a large comprehensive project under an Energy Savings Improvement Project (ESIP).

Install High Efficiency Hot Water Boilers

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
0	0.0	119.4	$1,004.82	$32,596.65	$2,987.60	$29,609.05	29.5	13,981

Measure Description

We recommend replacing older inefficient hot water boilers with high efficiency hot water boilers. Significant improvements have been made in combustion technology resulting in increased overall boiler efficiency. Energy savings results from improved combustion efficiency and reduced standby losses at low loads.

The most notable efficiency improvement is condensing hydronic boilers that can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Therefore, condensing hydronic boilers were only evaluated when we could be sure that the return water temperature could be configured to be less than 130°F during most of the operating hours, given the hot water circulating system and heating load. As a result, condensing hydronic boilers were not recommended for this site.

Reasons for not Recommending

For very old equipment which is reaching the end of its useful life, replacement cannot be justified solely on energy savings. However, in order to reduce operational and maintenance specific issues such as getting replacement parts, equipment reliability and redundancy – this measure evaluation was provided for demonstration purposes only. This measure may be implemented as more of a capital improvement project that may be rolled into a large comprehensive project under an Energy Savings Improvement Project (ESIP).

Our protocol is to only propose condensing boilers when we can verify that the return water temperature is currently below 130°F. Often the supply water and return water temperatures are a function of the type of heating equipment (equipment may be sized to require 160°F – 180°F supply water) and the hot water distribution – so if they are not currently operating with return water temps below 130°F the system may not be able to operate at that temperature. If a boiler replacement project is initiated, part of the design element will be to analyze the system and determine whether a condensing boiler should be considered.

Installation of an Energy Management System

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
5,751	0.0	120.6	$1,762.52	$53,275.50	$0.00	$53,275.50	30.2	19,917

Measure Description

The installation of an Energy Management System (EMS) increases the efficiency of the building HVAC system operation. Upgrade of controls to optimize the start/stop of all key HVAC equipment and tying in space temperature controls will minimize the amount of wasted energy. Schedules may be put in place to limit system operation when the building is closed. Temperature set back controls may be applied to operate systems only to the point necessary. Ventilation and economizer controls and programming would allow air handling units to operate according to room schedules, occupancy and availability for "free cooling" or "free heating." If this measure is of high interest regardless of the estimated payback period, we recommend that an HVAC contractor who specializes in energy management systems be contacted for a detailed evaluation and implementation.

Reasons for not Recommending

This measure is cost prohibitive. Installation of a sophisticated control system at this time is not recommended on the basis of energy savings alone due to the poor payback period. However, this measure was evaluated to demonstrate the potential savings and could be considered for other benefits, including tighter temperature control, comfort, and convenience. This measure evaluation was provided for demonstration purposes only. This measure may be implemented as more of a capital improvement project that may be rolled into a large comprehensive project under an Energy Savings Improvement Project (ESIP).

5 ENERGY EFFICIENT PRACTICES

In addition to the quantifiable savings estimated in Section 4, a facility's energy performance can also be improved through application of many low cost or no-cost energy efficiency strategies. By employing certain behavioral and operational changes and performing routine maintenance on building systems, equipment lifetime can be extended; occupant comfort, health and safety can be improved; and energy and O&M costs can be reduced. The recommendations below are provided as a framework for developing a whole building maintenance plan that is customized to your facility. Consult with qualified equipment specialists for details on proper maintenance and system operation.

Reduce Air Leakage

Air leakage, or infiltration, occurs when outside air enters a building uncontrollably through cracks and openings. Properly sealing such cracks and openings can significantly reduce heating and cooling costs, improve building durability, and create a healthier indoor environment. This includes caulking or installing weather stripping around leaky doors and windows allowing for better control of indoor air quality through controlled ventilation.

Close Doors and Windows

Ensure doors and windows are closed in conditioned spaces. Leaving doors and windows open leads to a significant increase in heat transfer between conditioned spaces and the outside air. Reducing a facility's air changes per hour (ACH) can lead to increased occupant comfort as well as significant heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

Use Window Treatments/Coverings

A substantial amount of heat gain can occur through uncovered or untreated windows, especially older single pane windows and east or west-facing windows. Treatments such as high-reflectivity films or covering windows with shades or shutters can reduce solar heat gain and, consequently, cooling load and can reduce internal heat loss and the associated heating load.

Perform Proper Lighting Maintenance

In order to sustain optimal lighting levels, lighting fixtures should undergo routine maintenance. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust on lamps, fixtures and reflective surfaces. Together, these factors can reduce total illumination by 20% - 60% or more, while operating fixtures continue drawing full power. To limit this reduction, lamps, reflectors and diffusers should be thoroughly cleaned of dirt, dust, oil, and smoke film buildup approximately every 6 – 12 months.

Develop a Lighting Maintenance Schedule

In addition to routine fixture cleaning, development of a maintenance schedule can both ensure maintenance is performed regularly and can reduce the overall cost of fixture re-lamping and re-ballasting. By re-lamping and re-ballasting fixtures in groups, lighting levels are better maintained and the number of site visits by a lighting technician or contractor can be minimized, decreasing the overall cost of maintenance.

Perform Routine Motor Maintenance

Motors consist of many moving parts whose collective degradation can contribute to a significant loss of motor efficiency. In order to prevent damage to motor components, routine maintenance should be performed. This maintenance consists of cleaning surfaces and ventilation openings on motors to prevent overheating, lubricating moving parts to reduce friction, inspecting belts and pulleys for wear and to ensure they are at proper alignment and tension, and cleaning and lubricating bearings. Consult a licensed technician to assess these and other motor maintenance strategies.

Use Fans to Reduce Cooling Load

Utilizing ceiling fans to supplement cooling is a low cost strategy to reduce cooling load considerably. Thermostat settings can be increased by 4°F with no change in overall occupant comfort when the wind chill effect of moving air is employed for cooling.

Practice Proper Use of Thermostat Schedules and Temperature Resets

Ensure thermostats are correctly set back. By employing proper set back temperatures and schedules, facility heating and cooling costs can be reduced dramatically during periods of low or no occupancy. As such, thermostats should be programmed for a setback of 5-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced further by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

Assess Chillers & Request Tune-Ups

Chillers are responsible for a substantial portion of a commercial building's overall energy usage. When components of a chiller are not optimized, this can quickly result in a noticeable increase in energy bills. Chiller diagnostics can produce a 5% to 10% cost avoidance potential from discovery and implementation of low/no cost optimization strategies.

Clean Evaporator/Condenser Coils on AC Systems

Dirty evaporators and condensers coils cause a restriction to air flow and restrict heat transfer. This results in increased evaporator and condenser fan load and a decrease in cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

Clean and/or Replace HVAC Filters

Air filters work to reduce the amount of indoor air pollution and increase occupant comfort. Over time, filters become less and less effective as particulate buildup increases. In addition to health concerns related to clogged filters, filters that have reached saturation also restrict air flow through the facility's air conditioning or heat pump system, increasing the load on the distribution fans and decreasing occupant comfort levels. Filters should be checked monthly and cleaned or replaced when appropriate.

Check for and Seal Duct Leakage

Duct leakage in commercial buildings typically accounts for 5% to 25% of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building, significantly increasing cooling and heating costs. By sealing sources of leakage, cooling, heating, and ventilation energy use can be reduced significantly, depending on the severity of air leakage.

Perform Proper Boiler Maintenance

Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to retain proper functionality and efficiency of the heating system. Fuel burning equipment should undergo yearly tune-ups to ensure they are operating as safely and efficiently as possible from a combustion standpoint. A tune-up should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is operating safely. Buildup of dirt, dust, or deposits on the internal surfaces of a boiler can greatly affect its heat transfer efficiency. These deposits can accumulate on the water side or fire side of the boiler. Boilers should be cleaned regularly according to the manufacturer's instructions to remove this build up in order to sustain efficiency and equipment life.

Perform Proper Water Heater Maintenance

At least once a year, drain a few gallons out of the water heater using the drain valve. If there is a lot of sediment or debris, then a full flush is recommended. Turn the temperature down and then completely drain the tank. Once a year check for any leaks or heavy corrosion on the pipes and valves. For gas water heaters, check the draft hood and make sure it is placed properly, with a few inches of air space between the tank and where it connects to the vent. Look for any corrosion or wear on the gas line and on the piping. If you noticed any black residue, soot or charred metal, this is a sign you may be having combustion issues and you should have the unit serviced by a professional. For electric water heaters, look for any signs of leaking such as rust streaks or residue around the upper and lower panels covering the electrical components on the tank. For water heaters over three to four years old have a technician inspect the sacrificial anode annually.

Plug Load Controls

There are a variety of ways to limit the energy use of plug loads including increasing occupant awareness, removing under-utilized equipment, installing hardware controls, and using software controls. Some control steps to take are to enable the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips. For additional information refer to "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices.

Water Conservation

Installing low-flow faucets or faucet aerators, low-flow showerheads, and kitchen sink pre-rinse spray valves saves both energy and water. These devices save energy by reducing the overall amount of hot water used hence reducing the energy used to heat the water. The flow ratings for EPA WaterSense™ (http://www3.epa.gov/watersense/products) labeled devices are 1.5 gpm for bathroom faucets, 2.0 gpm for showerheads, and 1.28 gpm for pre-rinse spray valves.

Installing dual flush or low-flow toilets and low-flow or waterless urinals are additional ways to reduce the sites water use, however, these devices do not provide energy savings at the site level. Any reduction in water use does however ultimately reduce grid level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users. The EPA WaterSense™ ratings for urinals is 0.5 gallons per flush (gpf) and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

Refer to Section 4.1.6 for any low-flow ECM recommendations.

6 On-Site Generation Measures

On-site generation measure options include both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) on-site technologies that generate power to meet all or a portion of the electric energy needs of a facility, often repurposing any waste heat where applicable. Also referred to as distributed generation, these systems contribute to Greenhouse Gas (GHG) emission reductions, demand reductions and reduced customer electricity purchases, resulting in the electric system reliability through improved transmission and distribution system utilization.

The State of New Jersey's Energy Master Plan (EMP) encourages new distributed generation of all forms and specifically focuses on expanding use of combined heat and power (CHP) by reducing financial, regulatory and technical barriers and identifying opportunities for new entries. The EMP also outlines a goal of 70% of the State's electrical needs to be met by renewable sources by 2050.

Preliminary screenings were performed to determine the potential that a generation project could provide a cost-effective solution for your facility. Before making a decision to implement, a feasibility study should be conducted that would take a detailed look at existing energy profiles, siting, interconnection, and the costs associated with the generation project including interconnection costs, departing load charges, and any additional special facilities charges.

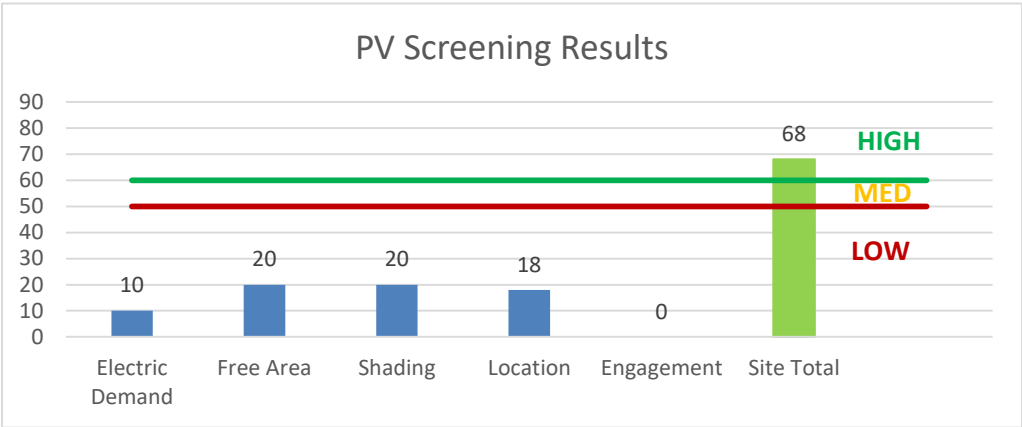
6.1 Photovoltaic

Sunlight can be converted into electricity using photovoltaics (PV) modules. Modules are racked together into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is interconnected to the facility's electrical distribution system. The amount of unobstructed area available determines how large of a solar array can be installed. The size of the array combined with the orientation, tilt, and shading elements determines the energy produced.

A preliminary screening based on the facility's electric demand, size and location of free area, and shading elements shows that the facility has a **high** potential for installing a PV array.

The amount of free area, ease of installation on the roof of the truck bay garage, and the lack of shading elements contribute to the high potential for PV at the site. A PV array located on the roof of the truck bay garage in the parking lot may be feasible. If the Water Works is interested in pursuing the installation of PV, we recommended a full feasibility study be conducted.

Figure 26 - Photovoltaic Screening



Solar projects must register their projects in the SREC (Solar Renewable Energy Certificate) Registration Program (SRP) prior to the start of construction in order to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about developed new solar projects and insight into future SREC pricing. Refer to Section 8.3 for additional information.

For more information on solar PV technology and commercial solar markets in New Jersey, or to find a qualified solar installer, who can provide a more detailed assessment of the specific costs and benefits of solar develop of the site, please visit the following links below:

- **Basic Info on Solar PV in NJ**: http://www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: http://www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs
- **Approved Solar Installers in the NJ Market**: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1

6.2 Combined Heat and Power

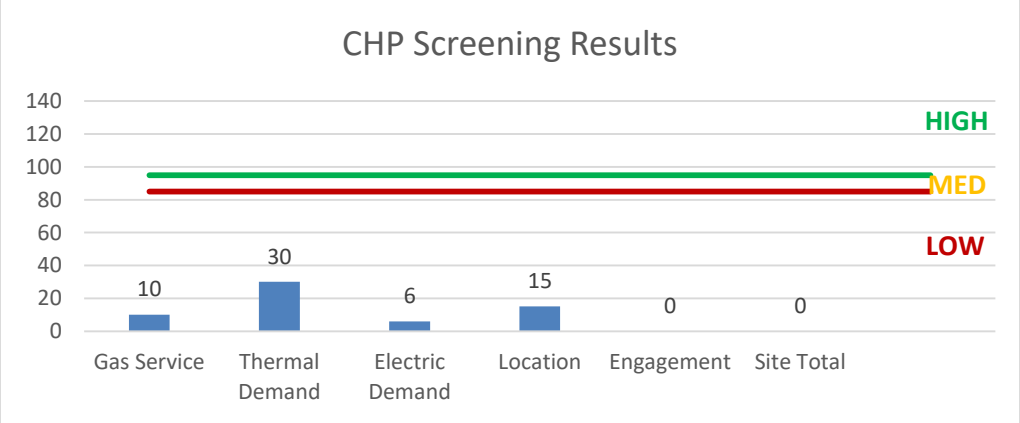
Combined heat and power (CHP) is the on-site generation of electricity along with the recovery of heat energy, which is put to beneficial use. Common technologies for CHP include reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines. Electric generation from a CHP system is typically interconnected to local power distribution systems. Heat is recovered from exhaust and ancillary cooling systems and interconnected to the existing hot water (or steam) distribution systems.

CHP systems are typically used to produce a portion of the electric power used onsite by a facility, with the balance of electric power needs supplied by grid purchases. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for the purpose of space cooling. The key criteria used for screening, however, is the amount of time the system operates at full load and the facility's ability to use the recovered heat. Facilities with continuous use for large quantities of waste heat are the best candidates for CHP.

A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility does not have potential for installing a cost-effective CHP system. Low or infrequent thermal load, and lack of space near the existing boilers are the most significant factors contributing to the potential for CHP at the site. In our opinion, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation.

For a list of qualified firms in New Jersey specializing in commercial CHP cost assessment and installation, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/.

Figure 27 - Combined Heat and Power Screening



7 DEMAND RESPONSE

Demand Response (DR) is a program designed to reduce the electric load of commercial facilities when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. Demand Response service providers (a.k.a. Curtailment Service Providers) are registered with PJM, the independent system operator (ISO) for mid-Atlantic state region that is charged with maintaining electric grid reliability.

By enabling grid operators to call upon Curtailment Service Providers and commercial facilities to reduce electric usage during times of peak demand, the grid is made more reliable and overall transmission costs are reduced for all ratepayers. Curtailment Service Providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary and participants receive payments whether or not their facility is called upon to curtail their electric usage.

Typically an electric customer needs to be capable of reducing their electric demand, within minutes, by at least 100 kW or more in order to participate in a DR program. Customers with a greater capability to quickly curtail their demand during peak hours will receive higher payments. Customers with back-up generators onsite may also receive additional DR payments for their generating capacity if they agree to run the generators for grid support when called upon. Eligible customers who have chosen to participate in a DR programs often find it to be a valuable source of revenue for their facility because the payments can significantly offset annual electric costs.

Participating customers can often quickly reduce their peak load through simple measures, such as temporarily raising temperature set points on thermostats, so that air conditioning units run less frequently, or agreeing to dim or shut off less critical lighting. This usually requires some level of building automation and controls capability to ensure rapid load reduction during a DR curtailment event. DR program participants may need to install smart meters or may need to also sub-meter larger energy-using equipment, such as chillers, in order to demonstrate compliance with DR program requirements.

DR does not include the reduction of electricity consumption based on normal operating practice or behavior. For example, if a company's normal schedule is to close for a holiday, the reduction of electricity due to this closure or scaled-back operation is not considered a demand response activity in most situations.

The first step toward participation in a DR program is to contact a Curtailment Service Provider. A list of these providers is available on PJM's website and it includes contact information for each company, as well as the states where they have active business (http://www.pjm.com/markets-and-operations/demand-response/csps.aspx). PJM also posts training materials that are developed for program members interested in specific rules and requirements regarding DR activity (http://www.pjm.com/training/training%20material.aspx), along with a variety of other DR program information.

Curtailment Service Providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding program rules and requirements for metering and controls, assess a facility's ability to temporarily reduce electric load, and provide details on payments to be expected for participation in the program. Providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment of their own to help ensure compliance with all terms and conditions of a DR contract.

In our opinion, this facility is not a good candidate for DR.

8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and other benefits to ratepayers, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey's Electricity Restructuring Law (1999), which requires all customers of investor-owned electric and gas utilities to pay a surcharge on their monthly energy bills. As a customer of a state-regulated electric or gas utility and therefore a contributor to the fund your organization is eligible to participate in the LGEA program and also eligible to receive incentive payment for qualifying energy efficiency measures. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 28 for a list of the eligible programs identified for each recommended ECM.

Figure 28 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings	Large Energy Users Program	Combined Heat & Power and Fuel Cell
ECM 1	Install LED Fixtures	x		x			
ECM 2	Retrofit Fixtures with LED Lamps	x		x			
ECM 3	Install LED Exit Signs			x			
ECM 4	Install Occupancy Sensor Lighting Controls	x		x			
ECM 5	Premium Efficiency Motors			x			
ECM 6	Install VFDs on Chilled Water Pumps			x			
ECM 7	Install VFDs on Hot Water Pumps			x			
ECM 8	Install High Efficiency Heat Pumps	x		x			
ECM 9	Install Low-Flow Domestic Hot Water Devices	x		x			
ECM 10	Vending Machine Control	x		x			
ECM 11	Computer Power Management Software			x			
ECM 12	Building Envelope Weatherization						

SmartStart is generally well-suited for implementation of individual measures or small group of measures. It provides flexibility to install measures at your own pace using in-house staff or a preferred contractor. Direct Install caters to small to mid-size facilities that can bundle multiple ECMs together. This can greatly simplify participation and may lead to higher incentive amounts, but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities. It requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants. The Large Energy Users Program (LEUP) is available to New Jersey's largest energy users giving them flexibility to install as little or as many measures, in a single facility or several facilities, with incentives capped based on the entity's annual energy consumption. LEUP applicants can use in-house staff or a preferred contractor.

Generally, the incentive values provided throughout the report assume the SmartStart program is utilized because it provides a consistent basis for comparison of available incentives for various measures, though in many cases incentive amounts may be higher through participation in other programs.

Brief descriptions of all relevant financing and incentive programs are located in the sections below. Further information, including most current program availability, requirements, and incentive levels can be found at: www.njcleanenergy.com/ci.

8.1 SmartStart

Overview

The SmartStart program offers incentives for installing prescriptive and custom energy efficiency measures at your facility. Routinely the program adds, removes or modifies incentives from year to year for various energy efficiency equipment based on market trends and new technologies.

Equipment with Prescriptive Incentives Currently Available:

Electric Chillers
Electric Unitary HVAC
Gas Cooling
Gas Heating
Gas Water Heating
Ground Source Heat Pumps
Lighting
Lighting Controls
Refrigeration Doors
Refrigeration Controls
Refrigerator/Freezer Motors
Food Service Equipment
Variable Frequency Drives

Most equipment sizes and types are served by this program. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades.

Incentives

The SmartStart prescriptive incentive program provides fixed incentives for specific energy efficiency measures, whereas the custom SmartStart program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentive offerings for specific devices.

Since your facility is an existing building, only the retrofit incentives have been applied in this report. Custom measure incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings, capped at 50% of the total installed incremental project cost, or a project cost buy down to a one year payback (whichever is less). Program incentives are capped at $500,000 per electric account and $500,000 per natural gas account, per fiscal year.

How to Participate

To participate in the SmartStart program you will need to submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. Applicants may work with a contractor of their choosing and can also utilize internal personnel, which provides added flexibility to the program. Using internal personnel also helps improve the economics of the ECM by reducing the labor cost that is included in the tables in this report.

Detailed program descriptions, instructions for applying and applications can be found at: www.njcleanenergy.com/SSB.

8.2 Direct Install

Overview

Direct Install is a turnkey program available to existing small to medium-sized facilities with a peak electric demand that does not exceed 200 kW, on average for a recent 12-month period. You will work directly with a pre-approved contractor who will perform a free energy assessment at your facility, identify specific eligible measures, and provide a clear scope of work for installation of selected measures. Energy efficiency measures may include lighting and lighting controls, refrigeration, HVAC, motors, variable speed drives and controls.

Incentives

The program pays up to 70% of the total installed cost of eligible measures, up to $125,000 per project. Direct Install participants will also be held to a fiscal year cap of $250,000 per entity.

How to Participate

To participate in the Direct Install program you will need to contact the participating contractor who the region of the state where your facility is located. A complete list of Direct Install program partners is provided on the Direct Install website linked below. The contractor will be paid the measure incentives directly by the program which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the program, subject to program caps and eligibility, while the remaining 30% of the cost is paid to the contractor by the customer.

Since Direct Install offers a free assessment of eligible measures, Direct Install is also available to small businesses and other commercial facilities too that may not be eligible for the more detailed facility audits provided by LGEA.

Detailed program descriptions and applications can be found at: www.njcleanenergy.com/DI.

8.3 SREC Registration Program

The SREC (Solar Renewable Energy Certificate) Registration Program (SRP) is used to register the intent to install solar projects in New Jersey. Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SRP prior to the start of construction in order to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing.

After the registration is accepted, construction is complete, and final paperwork has been submitted and is deemed complete, the project is issued a New Jersey certification number which enables it to generate New Jersey SRECs. SREC's are generated once the solar project has been authorized to be energized by the Electric Distribution Company (EDC).

Each time a solar installation generates 1,000 kilowatt-hours (kWh) of electricity, an SREC is earned. Solar project owners report the energy production to the SREC Tracking System. This reporting allows SREC's to be placed in the customer's electronic account. SRECs can then be sold on the SREC Tracking System, providing revenue for the first 15 years of the project's life.

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar RPS. One way they can meet the RPS requirements is by purchasing SRECs. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period can and will fluctuate depending on supply and demand.

Information about the SRP can be found at: www.njcleanenergy.com/srec.

8.4 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) is an alternate method for New Jersey's government agencies to finance the implementation of energy conservation measures. An ESIP is a type of "performance contract," whereby school districts, counties, municipalities, housing authorities and other public and state entities enter in to contracts to help finance building energy upgrades. This is done in a manner that ensures that annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive in year one, and every year thereafter. ESIP provides government agencies in New Jersey with a flexible tool to improve and reduce energy usage with minimal expenditure of new financial resources. NJCEP incentive programs can be leveraged to help further reduce the total project cost of eligible measures.

This LGEA report is the first step to participating in ESIP. Next, you will need to select an approach for implementing the desired ECMs:

(1) Use an Energy Services Company or "ESCO."
(2) Use independent engineers and other specialists, or your own qualified staff, to provide and manage the requirements of the program through bonds or lease obligations.
(3) Use a hybrid approach of the two options described above where the ESCO is utilized for some services and independent engineers, or other specialists or qualified staff, are used to deliver other requirements of the program.

After adopting a resolution with a chosen implementation approach, the development of the Energy Savings Plan (ESP) can begin. The ESP demonstrates that the total project costs of the ECMs are offset by the energy savings over the financing term, not to exceed 15 years. The verified savings will then be used to pay for the financing.

The ESIP approach may not be appropriate for all energy conservation and energy efficiency improvements. Entities should carefully consider all alternatives to develop an approach that best meets their needs. A detailed program descriptions and application can be found at: www.njcleanenergy.com/ESIP.

Please note that ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you may utilize NJCEP incentive programs to help further reduce costs when developing the ESP. You should refer to the ESIP guidelines at the link above for further information and guidance on next steps.

9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

9.1 Retail Electric Supply Options

In 1999, New Jersey State Legislature passed the Electric Discount & Energy Competition Act (EDECA) to restructure the electric power industry in New Jersey. This law deregulated the retail electric markets, allowing all consumers to shop for service from competitive electric suppliers. The intent was to create a more competitive market for electric power supply in New Jersey. As a result, utilities were allowed to charge Cost of Service and customers were given the ability to choose a third-party (i.e. non-utility) energy supplier.

Energy deregulation in New Jersey has increased energy buyers' options by separating the function of electricity distribution from that of electricity supply. So, though you may choose a different company from which to buy your electric power, responsibility for your facility's interconnection to the grid and repair to local power distribution will still reside with the traditional utility company serving your region.

If your facility is not purchasing electricity from a third-party supplier, consider shopping for a reduced rate from third-party electric suppliers. If your facility is purchasing electricity from a third-party supplier, review and compare prices at the end of the current contract or every couple years.

A list of third-party electric suppliers, who are licensed by the state to provide service in New Jersey, can be found online at: www.state.nj.us/bpu/commercial/shopping.html.

9.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey has also been deregulated. Most customers that remain with the utility for natural gas service pay rates that are market-based and that fluctuate on a monthly basis. The utility provides basic gas supply service (BGSS) to customers who choose not to buy from a third-party supplier for natural gas commodity.

A customer's decision about whether to buy natural gas from a retail supplier is typically dependent upon whether a customer seeks budget certainty and/or longer-term rate stability. Customers can secure longer-term fixed prices by signing up for service through a third-party retail natural gas supplier. Many larger natural gas customers may seek the assistance of a professional consultant to assist in their procurement process.

If your facility is not purchasing natural gas from a third-party supplier, consider shopping for a reduced rate from third-party natural gas suppliers. If your facility is purchasing natural gas from a third-party supplier, review and compare prices at the end of the current contract or every couple years.

A list of third-party natural gas suppliers, who are licensed by the state to provide service in New Jersey, can be found online at: www.state.nj.us/bpu/commercial/shopping.html.

Appendix A: Equipment Inventory & Recommendations

Lighting Inventory & Recommendations

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.13	193	0.0	$25.09	$292.50	$50.00	9.67
Meter Office	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,838	0.46	1,794	0.0	$233.08	$1,089.00	$175.00	3.92
Back Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,080	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,456	0.30	913	0.0	$118.68	$567.20	$110.00	3.85
Parts Shop	15	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	15	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.75	2,883	0.0	$374.59	$1,398.00	$260.00	3.04
Parts Storage	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,838	0.27	1,025	0.0	$133.19	$738.00	$80.00	4.94
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.10	384	0.0	$49.95	$266.40	$50.00	4.33
Office	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	6	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.30	1,153	0.0	$149.84	$567.20	$110.00	3.05
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.10	384	0.0	$49.95	$266.40	$50.00	4.33
Hallway	8	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	Yes	8	LED - Linear Tubes: (4) 2' Lamps	Occupancy Sensor	34	1,838	0.25	964	0.0	$125.20	$882.27	$160.00	5.77
Office/Lockers	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.20	769	0.0	$99.89	$570.80	$60.00	5.11
Storage Room	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	700	0.33	488	0.0	$63.40	$855.00	$100.00	11.91
Men's Restroom	1	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	1	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.01	22	0.0	$2.79	$39.00	$0.00	13.95
Men's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,626	0.04	152	0.0	$19.76	$75.20	$15.00	3.05
Women's Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	2,626	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,626	0.01	49	0.0	$6.39	$48.20	$10.00	5.98
Women's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.03	101	0.0	$13.18	$58.50	$10.00	3.68
Warehouse	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.10	384	0.0	$49.95	$420.40	$65.00	7.12
Warehouse	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,838	0.13	512	0.0	$66.59	$504.00	$75.00	6.44
Warehouse	47	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	Yes	47	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,838	1.56	6,022	0.0	$782.49	$4,099.50	$645.00	4.41
Vestibule	1	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	No	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,626	0.02	89	0.0	$11.58	$76.53	$20.00	4.88
Hallway	14	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	Yes	14	LED - Linear Tubes: (4) 2' Lamps	Occupancy Sensor	34	1,838	0.44	1,686	0.0	$219.11	$1,611.47	$280.00	6.08
Cafeteria	7	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,626	Relamp	Yes	15	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,838	0.15	581	0.0	$75.46	$1,697.00	$335.00	18.05
Cafeteria	1	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	No	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,626	0.02	89	0.0	$11.58	$76.53	$20.00	4.88
Vestibule	1	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	No	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,626	0.02	89	0.0	$11.58	$76.53	$20.00	4.88
Men's Locker Room	14	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	Yes	14	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,838	0.46	1,794	0.0	$233.08	$1,359.00	$210.00	4.93
Women's Locker Room	1	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	No	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,626	0.02	89	0.0	$11.58	$76.53	$20.00	4.88

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Women's Locker Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,838	0.20	769	0.0	$99.89	$621.00	$95.00	5.27
Storage Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,000	Relamp	No	4	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,000	0.16	232	0.0	$30.10	$300.80	$60.00	8.00
Closets	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.05	77	0.0	$10.03	$117.00	$20.00	9.67
Hallway	2	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	No	2	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,626	0.05	178	0.0	$23.16	$153.07	$40.00	4.88
Vestibule	1	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	No	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,626	0.02	89	0.0	$11.58	$76.53	$20.00	4.88
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	2,626	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,626	0.01	49	0.0	$6.39	$48.20	$10.00	5.98
Restroom	1	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	1	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.01	22	0.0	$2.79	$39.00	$0.00	13.95
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	2,626	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,626	0.01	49	0.0	$6.39	$48.20	$10.00	5.98
Restroom	1	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	1	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.01	22	0.0	$2.79	$39.00	$0.00	13.95
Lobby	6	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	Yes	6	LED - Linear Tubes: (4) 2' Lamps	Occupancy Sensor	34	1,838	0.19	723	0.0	$93.90	$729.20	$120.00	6.49
Vestibule	1	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	No	1	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,626	0.02	89	0.0	$11.58	$76.53	$20.00	4.88
Office	8	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.40	1,537	0.0	$199.78	$717.60	$140.00	2.89
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.10	384	0.0	$49.95	$266.40	$50.00	4.33
Hallway	2	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	2	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.01	43	0.0	$5.59	$78.00	$0.00	13.95
Accounts Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,080	Relamp	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,456	-0.08	-236	0.0	-$30.61	$877.07	$180.00	-22.77
Main Lobby	1	Metal Halide: (1) 250W Lamp	Wall Switch	295	2,626	Fixture Replacement	No	5	LED - Fixtures: Fuel Pump Canopy	Wall Switch	65	2,626	-0.02	-92	0.0	-$11.98	$4,900.00	$500.00	-367.36
Main Lobby	4	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	4	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.02	86	0.0	$11.18	$156.00	$0.00	13.95
Mechanical Shop	6	Metal Halide: (1) 250W Lamp	Wall Switch	295	2,626	Fixture Replacement	No	6	LED - Fixtures: High-Bay	Wall Switch	72	2,626	1.06	4,111	0.0	$534.19	$16,111.20	$900.00	28.48
Mechanical Shop	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.05	203	0.0	$26.35	$117.00	$20.00	3.68
Task Lights	33	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	No	33	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.87	3,346	0.0	$434.78	$1,930.50	$330.00	3.68
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.03	101	0.0	$13.18	$58.50	$10.00	3.68
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	2,626	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,626	0.01	49	0.0	$6.39	$48.20	$10.00	5.98
Restroom	1	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	1	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.01	22	0.0	$2.79	$39.00	$0.00	13.95
Garage	12	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,080	Relamp	No	12	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	0.32	964	0.0	$125.23	$702.00	$120.00	4.65
Overhang	2	Incandescent: Box Fixture	Wall Switch	100	2,626	Relamp	No	2	LED Screw-In Lamps: Screw in Lamps	Wall Switch	15	2,626	-0.02	-92	0.0	-$11.98	$107.51	$10.00	-8.14

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Stairs	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	No	6	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.16	608	0.0	$79.05	$351.00	$60.00	3.68
Stairs	6	Linear Fluorescent - T8: 2' T8 (17W) - 4L	Wall Switch	63	2,626	Relamp	No	6	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	34	2,626	0.14	535	0.0	$69.47	$459.20	$120.00	4.88
IT Department	6	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,000	Relamp	No	6	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	1,000	0.24	347	0.0	$45.15	$451.20	$90.00	8.00
Billing Office	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,080	None	Yes	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,456	0.05	148	0.0	$19.26	$270.00	$35.00	12.20
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,626	0.04	152	0.0	$19.76	$75.20	$15.00	3.05
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,626	0.04	152	0.0	$19.76	$75.20	$15.00	3.05
Open Office Area	44	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	44	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	2.19	8,456	0.0	$1,098.81	$4,388.80	$800.00	3.27
Back Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,080	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,456	0.15	457	0.0	$59.34	$341.60	$65.00	4.66
Back Hallway	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.20	769	0.0	$99.89	$570.80	$60.00	5.11
Admin Office Hallway	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	None	No	5	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Open Office Area	11	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	11	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.55	2,114	0.0	$274.70	$1,097.20	$200.00	3.27
Directors Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,080	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,456	0.15	457	0.0	$59.34	$341.60	$65.00	4.66
Directors Office	3	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,080	Relamp	No	3	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,080	0.02	51	0.0	$6.64	$117.00	$0.00	17.62
Directors Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,080	Relamp	No	4	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,080	0.06	170	0.0	$22.14	$143.60	$20.00	5.58
Restroom	1	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	1	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.01	22	0.0	$2.79	$39.00	$0.00	13.95
Restroom	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	33	2,626	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	2,626	0.01	49	0.0	$6.39	$48.20	$10.00	5.98
Office	3	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	3	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.02	65	0.0	$8.38	$117.00	$0.00	13.95
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	2,626	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	2,626	0.03	108	0.0	$13.97	$71.80	$10.00	4.42
Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	3	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.15	577	0.0	$74.92	$341.60	$65.00	3.69
Conference Room	4	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	1,400	Relamp	No	4	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	1,400	0.02	46	0.0	$5.96	$156.00	$0.00	26.18
Conference Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,400	Relamp	No	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,400	0.04	86	0.0	$11.17	$107.70	$15.00	8.30
Conference Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,400	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	980	0.20	410	0.0	$53.26	$416.80	$80.00	6.32
Conference Room	4	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	1,400	Relamp	No	4	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	1,400	0.02	46	0.0	$5.96	$156.00	$0.00	26.18
Conference Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	32	1,400	Relamp	No	3	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,400	0.04	86	0.0	$11.17	$107.70	$15.00	8.30
Conference Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	1,400	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	980	0.20	410	0.0	$53.26	$416.80	$80.00	6.32

	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Hallway	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	None	No	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Engineering Dept Office	22	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,080	Relamp	Yes	22	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,456	1.09	3,349	0.0	$435.17	$2,194.40	$400.00	4.12
Back Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,080	Relamp	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,456	0.10	304	0.0	$39.56	$266.40	$50.00	5.47
Storage Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.05	77	0.0	$10.03	$117.00	$20.00	9.67
Closets	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,000	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,000	0.05	77	0.0	$10.03	$117.00	$20.00	9.67
Hallway	2	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	2	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.01	43	0.0	$5.59	$78.00	$0.00	13.95
Men's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,626	0.04	152	0.0	$19.76	$75.20	$15.00	3.05
Men's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.03	101	0.0	$13.18	$58.50	$10.00	3.68
Women's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,626	0.04	152	0.0	$19.76	$75.20	$15.00	3.05
Women's Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,626	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.03	101	0.0	$13.18	$58.50	$10.00	3.68
Hallway	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	None	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,626	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Cafeteria	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,626	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,838	0.20	769	0.0	$99.89	$570.80	$95.00	4.76
Transition Spaces	20	Exit Signs: Incandescent	None	20	8,760	Fixture Replacement	No	20	LED Exit Signs: 2 W Lamp	None	6	8,760	0.22	2,870	0.0	$372.92	$2,151.10	$0.00	5.77
Hallway	3	Compact Fluorescent: 2 Plug in Lamps / Recessed Can	Wall Switch	14	2,626	Relamp	No	3	LED Screw-In Lamps: Plug in Lamps	Wall Switch	7	2,626	0.02	65	0.0	$8.38	$117.00	$0.00	13.95
Walkway and Parking	4	Metal Halide: (1) 250W Lamp	None	295	4,000	Fixture Replacement	No	4	LED - Fixtures: Outdoor Post-Mount	None	45	4,000	-0.14	-842	0.0	-$109.47	$2,293.20	$20.00	-20.77
Parking Lot	1	Metal Halide: (2) 400W Lamps	None	916	4,000	Fixture Replacement	No	1	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	None	240	4,000	-0.19	-1,123	0.0	-$145.96	$1,952.99	$100.00	-12.70
Parking Lot	4	Metal Halide: (1) 400W Lamp	None	458	4,000	Fixture Replacement	No	4	LED - Fixtures: Outdoor Pole/Arm-Mounted Area/Roadway Fixture	None	120	4,000	-0.38	-2,246	0.0	-$291.91	$7,811.97	$400.00	-25.39
Building Mounted	9	Metal Halide: (1) 250W Lamp	None	295	4,000	Fixture Replacement	No	9	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	45	4,000	-0.32	-1,895	0.0	-$246.30	$3,516.09	$900.00	-10.62
Truck Garage Bay	24	Metal Halide: (1) 250W Lamp	None	295	2,626	Fixture Replacement	No	24	LED - Fixtures: Fuel Pump Canopy	None	65	2,626	4.39	16,960	0.0	$2,203.85	$23,520.00	$2,400.00	9.58
Truck Garage Bay	7	Metal Halide: (1) 250W Lamp	None	295	4,000	Fixture Replacement	No	7	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	45	4,000	-0.25	-1,474	0.0	-$191.57	$2,734.74	$700.00	-10.62
Pump Station	8	Metal Halide: (1) 100W Lamp	None	128	4,000	Fixture Replacement	No	8	LED - Fixtures: Fuel Pump Canopy	None	30	4,000	-0.19	-1,123	0.0	-$145.96	$4,704.00	$800.00	-26.75
Pump Station	1	Metal Halide: (1) 100W Lamp	None	128	4,000	Fixture Replacement	No	1	LED - Fixtures: Other	None	30	4,000	-0.02	-140	0.0	-$18.24	$282.24	$5.00	-15.20
Back Garage	9	LED - Fixtures: Fuel Pump Canopy	None	50	2,000	None	No	9	LED - Fixtures: Fuel Pump Canopy	None	50	2,000	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Motor Inventory & Recommendations

		Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Annual Operating Hours	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Domestic Hot Water System	1	Water Supply Pump	0.1	72.0%	No	4,000	No	72.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boiler Burner Blower	1	Other	0.5	72.0%	No	3,542	No	72.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Hot Water Pumps	2	Heating Hot Water Pump	5.0	83.3%	No	3,542	Yes	89.5%	Yes	2	1.57	14,326	0.0	$1,861.65	$8,152.44	$0.00	4.38
Boiler Room	Chilled Water Pumps	2	Chilled Water Pump	5.0	85.5%	No	2,803	Yes	89.5%	Yes	2	1.45	10,900	0.0	$1,416.47	$8,152.44	$0.00	5.76
Boiler Room	Chilled Water Pumps	2	Chilled Water Pump	0.8	72.0%	No	2,803	No	72.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Men's Locker Room Furnace Fan	1	Supply Fan	0.3	72.0%	No	3,542	No	72.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Roof	Exhaust Fans	13	Exhaust Fan	0.3	72.0%	No	4,000	No	72.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Various	Unitary HVAC Equipment	34	Supply Fan	0.1	72.0%	No	6,345	No	72.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chiller	Condenser Fans	4	Exhaust Fan	1.0	72.0%	No	2,803	No	72.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Chiller	Condenser Fans	2	Exhaust Fan	0.5	72.0%	No	2,803	No	72.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Water Works	Elevator	1	Other	30.0	89.0%	No	365	No	89.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Outdoor	Split AC System	1	Split-System AC	1.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Indoor	Various	15	Packaged Terminal HP	1.00	10.24	Yes	15	Ductless Mini-Split HP	1.00	10.24	18.00	3.80	No	5.36	15,193	0.0	$1,974.32	$35,987.70	$1,380.00	17.53
Indoor	Various	7	Electric Resistance Heat		5.12	No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Outdoor	Split AC System	1	Split-System AC	1.50		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric Chiller Inventory & Recommendations

		Existing Conditions			Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Chiller Quantity	System Type	Cooling Capacity per Unit (Tons)	Install High Efficiency Chillers?	Chiller Quantity	System Type	Constant/ Variable Speed	Cooling Capacity (Tons)	Full Load Efficiency (kW/Ton)	IPLV Efficiency (kW/Ton)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof	Chilled Water System	1	Air-Cooled Scroll Chiller	40.00	Yes	1	Air-Cooled Scroll Chiller	Variable	40.00	1.24	0.74	4.96	5,190	0.0	$674.40	$55,002.40	$3,600.00	76.22
Roof	Chilled Water System	1	Air-Cooled Scroll Chiller	15.00	Yes	1	Air-Cooled Scroll Chiller	Variable	15.00	1.24	0.74	2.13	2,229	0.0	$289.70	$20,625.90	$1,350.00	66.54

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Hot Water	1	Non-Condensing Hot Water Boiler	1,358.00	Yes	1	Condensing Hot Water Boiler	1,358.00	91.00%	Et	0.00	0	119.4	$1,004.82	$32,596.65	$2,987.60	29.47

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Whole Building	1	Storage Tank Water Heater (> 50 Gal)	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Low-Flow Device Recommendations

	Recommedation Inputs				Energy Impact & Financial Analysis						
Location	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	6	Faucet Aerator (Lavatory)	2.20	1.00	0.00	0	12.3	$103.34	$43.02	$0.00	0.42
Restrooms	3	Faucet Aerator (Lavatory)	2.00	1.00	0.00	0	5.1	$43.06	$21.51	$0.00	0.50

Commercial Refrigerator/Freezer Inventory & Recommendations

	Existing Conditions			Proposed Condi	Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	ENERGY STAR Qualified?	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Lounge	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Lounge	1	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Lounge	2	Stand-Up Refrigerator, Solid Door (≤15 cu. ft.)	No	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Commercial Ice Maker Inventory & Recommendations

	Existing Conditions			Proposed Condi	Energy Impact & Financial Analysis						
Location	Quantity	Ice Maker Type	ENERGY STAR Qualified?	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Lounge	1	Ice Making Head (<450 lbs/day), Batch	Yes	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Water Works	59	Computer	120.0	
Water Works	18	Printer	250.0	
Water Works	9	Fan	100.0	
Water Works	2	Radio	25.0	
Water Works	7	Coffee Machine	900.0	
Water Works	7	Microwave	1,500.0	
Water Works	1	TV	120.0	
Water Works	6	Mini Fridge	260.0	
Water Works	1	Misc Equipment	4,000.0	

Vending Machine Inventory & Recommendations

	Existing Conditions		Proposed Conditions	Energy Impact & Financial Analysis						
Location	Quantity	Vending Machine Type	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Lounge Areas	2	Refrigerated	Yes	0.00	3,224	0.0	$418.90	$460.00	$0.00	1.10
Lounge Areas	2	Non-Refrigerated	No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Custom Recommendations

Computer Power Management Software

Normal Running Mode					Idle Running Mode					Suspended/Off Mode				
Mon - Fri 8AM-5PM	*Mon - Fri 5PM-8AM*	*Weekends & Holidays*	Energy Rate (W)*	Weekly Run Hours	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	*Weekends & Holidays*	*Energy Rate (W)**	*Weekly Run Hours*	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	*Weekly Run Hours*
80%	30%	10%	120	**61**	10%	12%	6%	80	**16**	10%	58%	84%	5	**91**
75%	5%	0%	120	**34**	5%	5%	0%	80	**6**	20%	90%	100%	5	**128**

Usage per Device			Energy Impact & Financial Analysis					
Weeks of Use	Annual kWh Usage	*Diversity Factor***	Total Annual kWh Savings	Total Annual Energy Cost Savings	*Cost per Desktop*	*Add'l Hardware Cost*	Total Installation Cost	Simple Payback Period (Years)
48	435	90%	8,873	$1,153	$15.00	$2,500.0	$3,385	2.94
48	268							

Building Envelope Weatherization

Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis				
Annual Electric HVAC Energy Use (kWh)	*Annual Heating Energy Use (mmBtu)*	Assumed % Electric HVAC Savings	Assumed % Gas HVAC Savings	Total Annual kWh Savings	Total Annual mmBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
29,078	1,206.4	0.5%	4.0%	145	48	$425	$4,535	10.67

	qty	$/unit	est. costs
Weather-strip Exterior Double Doors	1	250	$ 250
Weather-strip Exterior Single Doors	5	125	$ 625
Weather-strip Exterior Overhead Doors	2	750	$ 1,500
Caulk the Perimeter of Windows	540	4	$ 2,160
		Total Estimated Costs	**$ 4,535**

Installation of an Energy Management System

Existing Conditions			Proposed Conditions			Energy Impact & Financial Analysis				
Annual Electric HVAC Energy Use (kWh)	*Annual Heating Energy Use (mmBtu)*	*Annual Fan Energy Use (kWh)*	Assumed % Cooling Savings	Assumed % Heating Savings	Assumed % Motor Savings	Total Annual kWh Savings	Total Annual mmBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Simple Payback Period (Years)
29,078	1,206.4	100,152	6%	10%	4%	5,751	121	$1,763	$53,276	30.23

Equations: (Based on Industry Standards)
Average Cost for EMS installation is $1.50/sqft
Energy savings range between 10% and 30%

Appendix B: ENERGY STAR® Statement of Energy Performance

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Water Works

Primary Property Type: Office
Gross Floor Area (ft²): 35,517
Built: 1958

For Year Ending: July 31, 2016
Date Generated: August 08, 2018

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Water Works 333 Cortland Street Trenton, New Jersey 08638	City of Trenton 319 East State Street Trenton, NJ 08618 (___)___-_____	Hoggarth Stephen 319 East State Street Trenton, NJ 08618 6099893615 hstephen@trentonnj.org

Property ID: 6436908

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
71.5 kBtu/ft²

Source EUI
151 kBtu/ft²

Annual Energy by Fuel		
Natural Gas (kBtu)	1,250,455 (49%)	
Electric - Grid (kBtu)	1,289,409 (51%)	

National Median Comparison	
National Median Site EUI (kBtu/ft²)	93.7
National Median Source EUI (kBtu/ft²)	197.9
% Diff from National Median Source EUI	-24%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	210

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____ Date: _____

Licensed Professional

___ _____
.
(___)___-_____
_____

Professional Engineer Stamp (if applicable)